

## Leonard Launches Nationwide Series Of Dealers Meetings

(Concluded from Page 1, Column 1) the session, which was conducted by Messrs. Strelinger and Mitchell. Second dealer meeting was held Jan. 16 in Cincinnati.

Mr. Strelinger and Mr. Mitchell, during the remainder of the month, will hold sessions in Los Angeles, San Diego, and San Francisco. From there they will go to the Pacific Northwest, conducting conventions in Seattle, Wash., and Portland, Ore.

They will also conduct meetings at Oklahoma City, Louisville, Milwaukee, Chicago, Omaha, Des Moines, New York City, Albany, Syracuse, Pittsburgh, Philadelphia, Washington, New Haven, Providence, Boston, and Detroit.

Sessions at El Paso, Phoenix, Spokane, Boise, Salt Lake City, Denver, New Orleans, Birmingham, Atlanta, Jacksonville, Miami, Nashville, Baltimore, Portland, Me., Rochester, N. Y., and Burlington, Vt., will be directed by Mr. Strelinger.

Mr. Mitchell will be the factory representative at meetings in Tulsa, Dallas, San Antonio, and Minneapolis. Mr. Ludington will direct the gatherings at Columbus, Grand Rapids, Saginaw, and will attend the Rochester meeting with Mr. Strelinger.

### Terry Appointed Gibson Production Manager

(Concluded from Page 1, Column 1) tory, Mr. Terry was connected with General Motors Corp. for 11 years. First five of these were spent with General Motors Research Corp. as research engineer, and during the last six he served Frigidaire Corp. in the following capacities: material engineer, chief receiving inspector, assistant chief inspector in charge of final tests and final inspection, production manager of the absorption division (Faraday), development engineer in charge of design of commercial gas refrigeration unit.

C. M. Brown, who has been Gibson's production manager, has resigned to become president and general manager of Household Products Corp., Hillsdale, Mich.

## 20% of West Penn Co. Customers Own Refrigerators

PITTSBURGH—Twenty per cent of the 127,241 customers of the West Penn Power Co. here now have electric refrigeration, according to a survey made recently by the utility to secure data upon which it will base future load-building campaigns.

It was also revealed that of these customers, 81.75 per cent have radios, 78.74 per cent have electric washers, 3.13 per cent have ironers, 3.09 per cent have electric ranges, and .21 per cent have electric water heaters.

West Penn estimates that "the average customer with no major appliances uses 19 kilowatt hours per month and pays an average bill of \$1.40; with a radio and washer, he uses 44 kilowatt hours and pays a bill of \$2.47; with a radio, refrigerator, and washer, he uses 97 kilowatt hours costing \$4.06."

Say the utility's statisticians: "Relatively few customers have more than three major appliances. Those having radio, refrigerator, washer, ironer, and range consume an average of 266 kilowatt hours monthly, with a bill of \$7.68. A water heater adds about 2,000 kilowatt hours per year, and \$2.75 to the monthly bill."

About one-third of the current consumed by the average customer is used for lighting and operation of small appliances such as toasters, electric irons, etc., the company has found.

### Grunow Franchises 5 Distributors

CHICAGO—General Household Utilities Co. has franchised the following new distributors: Nassau Distributing Co., Trenton, N. J.; Electric Appliance Distributors, Altoona, Pa.; Morris Distributing Co., Albany, N. Y.; Shapiro Sporting Goods Co., Newburgh, N. Y.; and J. L. Perry Co., Nashville, Tenn.

### Sears Roebuck Will Air Condition New Store

CHICAGO—Installation of air-conditioning equipment is planned for Sears Roebuck & Co.'s new five-story department store which is to be built at 63rd and Halsted Sts. here.

## DeLuxe Jewett



Jewett Refrigerator Co.'s new model with cold storage drawer opened out. This drawer, designed for fruits and vegetables, is refrigerated by ducts on both sides.

### Refrigerated Drawer Used in New Jewett

(Concluded from Page 1, Column 3) the comparatively high temperatures maintained in the drawer.

The drawer is removable for cleaning purposes, Mr. Jewett declares.

Compressor in the new model is located in the rear of the cabinet at the top with refrigerant lines connected on a horizontal plane to the evaporator, which is located in the center of the cabinet at the top. Bottle storage space is provided at both sides of the evaporator by this arrangement.

Installation or removal of the unit is accomplished by lifting off the top of the cabinet and raising the unit out.

Model D-70 has a net food storage capacity of 6.5 cu. ft. and a shelf area of 12.75 sq. ft. Four ice cube trays furnish 112 cubes (10.3 lbs.) at one freezing.

Insulation is 3 in. of Temlock. Exterior finish is lacquer, and the cabinet is styled with rounded corners at the top. Interior finish is porcelain. Hardware is chromium plated. An added feature is an interior electric light which is concealed in a chromium-plated reflector.

## Appliance Consumption Tabulated by Georgia Power Co.

ATLANTA—Georgia Power Co. here has just prepared for its sales department a table showing the estimated average monthly kilowatt-hour consumption of electric appliances. Of 29 appliances listed, storage water heaters are rated highest, with 350 kwh., electric ranges next with 100 to 300 kwh., and household refrigerators third with 50 to 100 kwh.

Following are the other items on the list, given in alphabetical order, and followed by their monthly kwh. consumption:

Clock (synchronous), 1½; cooker (egg), 1½; cooker (fireless), 7½; curling iron, 1; dishwasher, 2½; fan (desk), 1½; fan (ceiling), 2½; fan (exhaust), 3; food mixer, 2; grills and hot plates, 3; hair dryer, 1; heater (space type), 1,000 watts), 15; ironer (2,000 watts), 15.

Mazda lamp bulbs—40-watt, 5; 60-watt, 7½; 100-watt, 12½; motor (small), 4; motor (sewing machine), 1½; percolator or coffee maker, 3; pump (water), 20; radio, 10; sun lamp, 8½; table stove, 1½; toaster, 3; vacuum cleaner, 3; waffle iron, 2; warming pad, 1; washing machine 2.

### Sell 5,276 Refrigerators In South Jersey

CAMDEN, N. J.—During 1933, 5,276 electric refrigerators were sold in the territory composed of Camden, Burlington, Salem, and Gloucester counties, according to the Electrical League of South Jersey here. This is an increase of 1,076 over 1932.

Approximately 60 per cent of 1933 sales were made in Camden county, the league reports. Total dollar volume from sales in the four counties was \$976,060, average unit sale price being \$185. The association states that 1933 business set a new high record for refrigeration sales in this territory.

### Mitchell & Smith Opens Office in Cambridge

DETROIT—Mitchell & Smith, Inc., manufacturer of cork insulation, has opened an eastern office at 270 Albany St., Cambridge, Mass. The office will be in charge of Paul E. Flotron.

## Court Sets Aside Verdict in Suit for Majestic Royalties

CHICAGO—Verdict rendered in the municipal court here on Nov. 10 in favor of Jos. H. Tigerman against Grigsby-Grunow Co. for \$26,250 was set aside Jan. 3 and a new trial ordered by Judge Justin F. McCarthy.

Mr. Tigerman is one of the parties who joined in the bankruptcy petition recently filed in the Federal Court and dismissed by Federal Judge Barnes.

Mr. Tigerman's claim is for royalties said to be owing under a contract relating to an alleged invention for battery eliminators. No patent was ever granted to him, however, and the company claims that the contract was terminated in accordance with its terms.

Judge McCarthy, in vacating the verdict and ordering a new trial, stated his belief that the verdict should have been for the defendant, and not for the plaintiff. Grigsby-Grunow Co. was represented by its general counsel, Albert F. Mecklenburger and Thorley Von Colst.

### New York Crosley Dealers Preview New Models

NEW YORK CITY—Crosley dealers in the metropolitan New York area were guests of the Crosley Distributing Corp., wholesaler of Crosley products here, at a preview of Crosley Radio Corp.'s 1934 refrigeration and radio lines in Hotel Pennsylvania Jan. 11 and 12.

Fielding Robinson is general manager of the distributorship, and Grant Layng is sales manager.

### All General Electric Orders Increase 17% in 1933

SCHENECTADY, N. Y.—Orders received by all divisions of the General Electric Co. during the year 1933 amounted to \$142,770,791, compared with \$121,725,772 for 1932—an increase of 17 per cent, President Gerard Swope announced Jan. 9.

Orders for the quarter ended Dec. 31 amounted to \$37,985,790, compared with \$27,351,658 for the last quarter of 1932, an increase of 39 per cent.

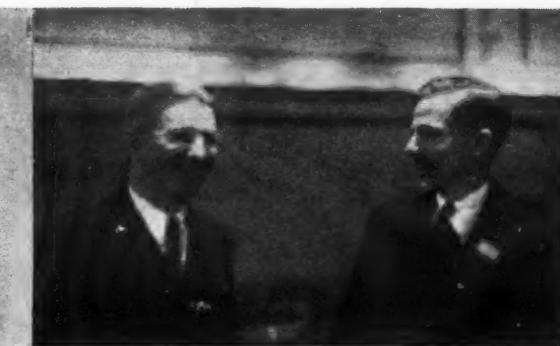
## Candid Camera Records Activity at Crosley & Westinghouse Meetings



Howard Richardson (left), new assistant to Powel Crosley, Jr., in charge of sales, drives home a point.



Powel Crosley, Jr. (right) listens attentively to a radio message from President Roosevelt during a recess in a distributors' meeting.



Advertising Manager G. H. Corbett and Neil Bauer register happiness over the prospects of new business for Crosley.



Powell Crosley, III, inventor of the Crosley Tray-Fre compound, talks it over with Vice President Lewis Crosley.



President C. C. Hull of Rex shows the interior of a new Crosley Tri-Shelvador to Jack Schaefer of the News.



Neil Bauer listens for the sentiment of Crosley distributors.



Tablecloths are handy for figuring possible profits based on the discounts these distributors have just heard at the Crosley convention.



One corner of the recent Westinghouse supervisors' meeting.



J. J. Moffatt, Westinghouse supervisor from Chicago, occupies the only comfortable chair at the meeting.



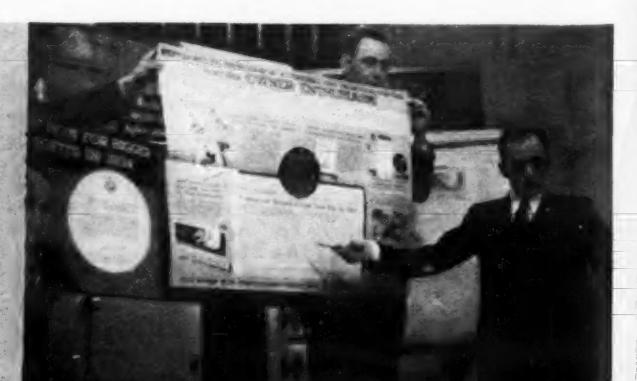
Jim Newcomb and Ray Cosgrove of the Westinghouse refrigeration department, caught informally at the meeting.



Jerry O'Donnell, new merchandising manager of Westinghouse's central division, ponders a problem.



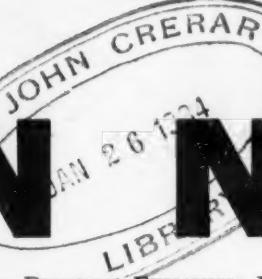
Messrs. Lopez of Mexico City and Alvarez of Buenos Aires listen attentively to the proceedings at the Westinghouse supervisors' conclave.



Roger Bolin outlines the Westinghouse Complete Coverage Campaign to assembled supervisors in Mansfield. (Reported in Jan. 10 issue.)

# ELECTRIC REFRIGERATION NEWS

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## NEW STEWART-WARNER CABINETS STYLED

### Sunbeam Forms Division to Sell 'Major' Models

#### Complete Refrigerators to Be Sold Direct to Dept. Stores

CHICAGO—Major Appliance Corp. has been formed here as a division of the Sunbeam Electric Mfg. Co. to manufacture and sell Major electric refrigerators.

W. A. Carson, president of Sunbeam, is also president of the new firm. H. F. MacGrath, formerly with Leonard Refrigerator Co., is vice president in charge of sales, and J. Henry Schroeder is secretary and treasurer.

Main offices of the new company are in the Merchandise Mart here. Present sales policy is direct to department stores, with no list price, prices being net to the stores, Mr. MacGrath states. Production on the line has started and deliveries will begin next month.

Chief sales feature of the six-model Major line is the "tempostat," an indicating needle on the control panel which shows the owner at a glance if the temperature is above or below 50° F. by pointing to either "normal" or "too warm."

Sunbeam condensing units and See-ger cabinets are used in the Major models. Cabinets are distinguished by modified paneling on the door and sides, and have broom-high legs. Hardware is semi-concealed.

The unit is a sealed, direct-drive rotary type, carrying a one-year guarantee, with an additional guarantee to recondition after five years, if necessary, at a cost not to exceed \$25.

The evaporator has a porcelain front, and is placed in the center of the cabinet, providing a double bottle (Concluded on Page 6, Column 4)

### Hearing Monday on Refrigeration Code

WASHINGTON, D. C.—Public hearings on the proposed code of fair competition for the electric refrigeration industry will be held Monday, Jan. 29 in room 3204 of the Department of Commerce building under the supervision of Deputy Administrator H. O. King, it has been announced by the National Recovery Administration.

The proposed code will be presented by the Refrigeration Division of the National Electrical Manufacturers' Association and will be supplemental to the basic Nema code which governs the electrical industry.

The refrigeration code would provide for trade practices, advertising and sales promotion, replacement charges, trade allowances, etc. The industry operates under the wage and hour provisions of the Nema code.

### 6 Manufacturers Spend \$853,156 for Ads In Magazines

DETROIT—National magazine advertising by six manufacturers of electric refrigeration for 1933 as reported by the Curtis Publishing Co. amounted to \$853,156.00 showing a decrease of about 36 per cent when compared with the \$1,332,980.00 spent by the same companies in 1932.

The report includes expenditures by Kelvinator, Frigidaire, General Electric, Crosley, Leonard, and Grigsby-Grunow. At the present time no records of advertising in national magazines are available for such magazine space users as Gibson, Norge, Westinghouse, Servel, and Grunow.

Kelvinator Corp. leads the manufacturers with an appropriation of \$282,700 while Frigidaire Corp. was second with \$258,355, and General Electric Co. spent \$194,975 to rank third.

Saturday Evening Post carried the largest amount of refrigeration advertising (Concluded on Page 6, Column 3)

### Fin Coil Code Bars Below-Cost Sales

WASHINGTON, D. C., Jan. 24.—Selling below cost is prohibited in the proposed code of fair competition for the extended surface industry, hearings on which are scheduled to start today (Wednesday) in the Washington hotel here. The extended surface industry is defined to mean manufacturers of fin type evaporators, condensers, or other extended surface parts used for heat transfer purposes in refrigeration and air conditioning.

"Cost" is defined in the proposed code to include first the cost of material, plus direct labor, plus overhead.

"Cost of material" is defined to include all items that enter into and become part of the product and on which a specific charge per unit can be made at the current delivered market for same.

"Direct labor" is defined as all items of labor which are directly applicable to the product and add to its value and/or on which a direct or specific charge can be made at fair wages for employees.

"Overhead" is defined to include all items of expense other than material (Concluded on Page 8, Column 2)

### Philipp Will Address Detroit A.S.R.E.

DETROIT—Dr. L. A. Philipp, director of research for Kelvinator Corp., will address the next meeting of the Detroit A.S.R.E. at 8 o'clock next Monday night, Jan. 29, in the small ballroom of the Statler hotel. His topic is to be "Thermodynamics of SO<sub>2</sub>—Oil Systems."

Lester Keilholz, research engineer for Norge Corp., will preside.

### Underwriters Issue Extensive Report On Hazards of Refrigerants

CHICAGO—Delving further than any previous investigation into the comparative life, fire, and explosion hazards of all common refrigerants (and some uncommon ones), a new 118-page report has just been issued by the Underwriters' Laboratories.

The extensive series of tests on which the report is based were financed by Kinetic Chemicals, Inc., subsidiary of E. I. duPont de Nemours which manufactures Freon and other new refrigerants of the same chemical family. The report was prepared by A. H. Nuckolls, chemical engineer of the Underwriters' Laboratories.

Refrigerants considered include ammonia, butane, carbon dioxide, dichloroethylene, dichlorodifluoromethane (Freon), dichlorotetrafluoroethane (F-114), ethane, ethyl bromide, ethyl chloride, methyl bromide, methyl chloride, methyl formate, methylene chloride, monofluorotrichloromethane (F-11), propane, sulphur dioxide, and for comparative test purposes carbon tetrachloride and chloroform.

The work investigates three main phases of the hazards of refrigerants: (1) the comparative life hazards, that is the toxic or any harmful action of refrigerant gases breathed into the human body. (2) the hazard of refrigerants, or their products of decomposition, in the presence of a flame or hot objects, and (3) fire and explosion hazards.

Large two and three-page tables are incorporated in the report to tabulate the results of toxicity tests, toxicity tests of decomposition products, analyses of the products of decomposition in the presence of gas flames and hot electric range units, and fire and explosion data.

#### Plan of Investigation

Pertinent excerpts from Mr. Nuckolls' report follow:

An escaping refrigerant may be exposed to oil (petroleum) or wood fires. A comparatively hot oil flame, such as is produced by a well-designed oil burner, and wood fires of moderate intensity were included in the tests to give some data on the decomposition of refrigerants under fire conditions.

Although formed in relatively small quantity by contact of certain refrigerants with flame, phosgene is the outstanding compound discussed in the literature on this subject.

While there is general agreement among authorities as to the toxicity (Continued on Page 8, Column 3)

### Compressor Is Refined; Nine Models in Line

#### Rolling Shelves Will Be Featured; Lowest Price \$129.50

By Elston D. Herron

Chicago, Ill.—Charles R. D'Olive ripped open that much-advertised packing case in the lobby of Stewart-Warner's factory here last Friday, and let folks see for themselves what the company's 1934 refrigerator is like. First things visiting distributors saw were conservative styling, shelves that slide in and out on rollers, and a twin-cylinder reciprocating compressor somewhat more refined than last year's.

Prices range from \$129.50 (f.o.b. factory) for a 4.6-cu. ft. lacquer model to \$295.50 for an 8.3-cu. ft. all-porcelain refrigerator. Refrigeration Manager D'Olive's plans call for manufacture of 50,000 units this year. Production is now under way.

Stewart-Warner has two new lines—one standard, the other deluxe. In the former are three models, while the deluxe line comprises six models, three finished in lacquer, and three in porcelain.

Cabinets of standard models are, on the exterior, exactly the same as those in the company's 1933 line. But the interior of these refrigerators is changed considerably. Each standard model has embossed shelf supports (instead of hooks), and a porcelain evaporator which is centrally located. Compressors are the same in both lines (see specifications on page 7 of this issue).

In the deluxe group, cabinets are basically the same as those used last season, but have been given a streamlined appearance by use of semi-

(Continued on Page 7, Column 1)

### Auditorium to License Air-Conditioning Manufacturers

By George F. Taubeneck

NEW YORK CITY—Auditorium Conditioning Corp., an organization which holds—and is still acquiring—a considerable number of patents in the air-conditioning field, is now licensing manufacturers of unit air conditioners to incorporate in their units the features controlled by Auditorium patents.

Specified royalties on each Auditorium patent used will be paid by unit manufacturers operating under the license. Manufacturers may then sell (Continued on Page 6, Column 4)

### New Cabinet Lines, More Features



Charles R. D'Olive shows visiting distributors how to use the removable shelf feature of the new Stewart-Warner refrigerator, introduced last week in Chicago (see announcement at right).

## MORE OPINIONS OF DISTRIBUTORS APPEAR IN THIS ISSUE

**Editor's Note**—Opinions of electric refrigeration distributors on the sales outlook in their territories start below, and continue on pages 2 and 4. Letters from 26 distributors whose names are listed on page 2 of this issue were published last week.

### Graybar Plans Dealer Expansion Program

Graybar Electric Co., Inc.  
Lexington Ave. and 43rd St.  
New York City

Editor: Jan. 16, 1934.

Reports from our distributing houses and dealers throughout the country indicate that 1933 was a satisfactory refrigerator year. In view of business conditions during the past year, our volume was very gratifying.

We look forward to a better refrigerator business this year both in volume and profit. Our plans for 1934 include the expansion of our dealer organization and a closer contact with and development of each dealer.

Refrigeration and air conditioning, both domestic and commercial, will, we believe, show a satisfactory growth with the return of better economic conditions.

Electrical appliances—washing machines, ranges, vacuum cleaners, etc.—will have given a very good account of themselves during the past year and we are planning for a larger sales volume in 1934.

HERBERT METZ,  
Sales promotion manager.

### Future Market Hinges on Cheap Boxes—Bauder

George T. Bauder Co.  
General Electric Appliances  
San Diego, Calif.

Editor: Jan. 15, 1934.

The year 1933 was better than 1932—not good however.

Our dealer outlets decreased in number due to utilities cutting down on merchandising. We will expand in 1934.

The household refrigerator selling future is only fair unless the cheap

unprofitable boxes are removed from the market. Air-conditioning market looks good if it is not ruined by installation of unsatisfactory equipment. The beer-cooling market is limited, and the future for commercial equipment is good but limited also. Other appliances in the future will show reasonable possibilities.

GEORGE T. BAUDER.

### Tri State's Refrigeration Business Best

Tri State Electric Co.  
407 E. Eighth St., Sioux Falls, S. D.

Editor: Jan. 17, 1934.

Our Kelvinator department for the year 1933 was the most profitable part of our operation and we expect to expand our own activity, our dealer activities, and dealer organization during 1934.

Of course, Kelvinator's excellent dealer leadership plan should receive a great deal of credit for our increased sales and our desire to expand our activities in our Kelvinator department.

Without doubt, business is on the upturn and I look forward during 1934 with a more optimistic view than I have had for the past several years. We further expect to increase our efforts on air conditioning, commercial refrigeration, and beer coolers, as well as on ranges, washing machines, vacuum cleaners, and dishwashers.

N. T. RONAN,

Vice president and manager of sales.

### Commercial Business Increasing—Kline

Iron City Electric Co.  
Sixth Ave. & Diamond St., Pittsburgh

Editor: Jan. 15, 1934.

Our sales of Westinghouse refrigerators during 1933 were highly satisfactory. Notwithstanding a severe shortage of merchandise during the peak months and serious labor troubles throughout the coal fields in the late summer, we were able to show an increase over 1932 unit sales of 50 per cent.

We plan to secure more complete dealer coverage this spring and anticip-

ate an even greater volume of sales during 1934.

There is an increasing demand for commercial equipment from farmers for milk cooling and retail merchants for display counters and storage cabinets. Ranges, washing machines, vacuum cleaners, and food mixer sales have shown a remarkable increase in volume during the past nine months.

Frequently inquiries for information on dishwashers indicate that we may anticipate a substantial business from them during 1934.

W. M. KLINE,  
Manager, refrigeration dept.

### AAA & CWA Programs to Help Iowa—Murphy

Sidles-Duda-Myers Co.  
Grunow Electric Refrigerators  
Des Moines, Iowa

Editor: Jan. 16, 1934.

We are serving a territory in the central part of the State of Iowa that is being blessed with a tremendous daily cash income such as the govern-

(Continued on Page 2, Column 1)

## OPINIONS

(Continued from Page 1, Column 5)

ment hog corn program, CWA work. According to all available figures, there will be a release in the state of Iowa around June 1 approximately one hundred million dollars, which is going to make a boom in this territory.

Our experience with electric refrigeration in 1933 was both satisfactory and profitable. We increased our number of dealer outlets, and we expect to further expand and increase our dealer organization in 1934. There is more interest in electric refrigeration at the present time, and we would be inclined to predict that the 1934 electric refrigeration business will show an increase of from 30 to 40 per cent over 1933.

We believe that the consuming public will have more money to spend—therefore, they will no doubt buy larger equipment and be in position to make larger down payments, thus becoming much better credit risks, all of which will help us show the predicted increase in the industry.

M. J. MURPHY, Manager.

### Burke Expects to Increase Sales 100%

J. H. Burke Co.  
Wholesale Distributors  
Leonard Electric Refrigerators  
221 Columbus Ave., Boston

Jan. 13, 1934.

Editor:

We are extremely optimistic, and are anticipating an increase in our own volume of approximately 100 per cent over the previous year, even though the sale of Leonard, which is the line we distribute, increased about the same percentage in 1933 over 1932.

Please do not understand from this that we feel there is anything like this percentage of improvement ahead for the industry as a unit. We do believe,

however, that during this new year we are going to enjoy substantially improved economic conditions generally, and that all legitimate manufacturers are going to be presented with an opportunity to share in an extended market for electric refrigeration, and further, that all such manufacturers are going to profit as a result of these conditions to the extent of their ability to produce the right kind of salable merchandise at the right prices, and supported by the right type and volume of advertising and sales promotion activities.

During 1933 we practically doubled our retail dealer outlets, and have been successful in attracting to the merchandising of our product the type

1117 Main St., Wheeling, W. Va.  
Editor: Jan. 15, 1934.

Regarding our experience in selling refrigerators in 1933, wish to advise that we took on the Grunow line of refrigerators and have met with unusual success in the sale of these Grunow refrigerators and we do not hesitate to say that it proved a very profitable and satisfactory line.

We are now looking forward to the greatest year in refrigeration since household refrigeration inception.

We have continually increased our number of dealer outlets and we are looking forward to a definite expansion in our territory on household refrigeration.

A. K. CLIFFORD.

1117 Main St., Wheeling, W. Va.  
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Modern Home Utilities, Inc., Waterbury, Conn., J. E. Nelly.

Mueller Lumber Co., Davenport, Iowa, M. W. Andresen.

Pixley Electric Supply Co., Columbus, Ohio, L. R. Krumm.

Radio Equipment Co., South Bend, Ind., J. H. Sunderlin.

A. A. Schneiderhahn Co., Des Moines, Iowa, A. A. Schneiderhahn.

Southern Equipment Co., San Antonio, Tex., E. Chaney.

Straus-Bodenheimer Co., Houston, Tex., D. H. Straus.

Watkins-Cottrell Co., Roanoke, Va.

Witte Hardware Co., St. Louis, Mo., R. C. Houck.

Frank W. Wolf, Inc., Buffalo, Frank W. Wolf.

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Pixley Electric Supply Co., Columbus, Ohio, L. R. Krumm.

Radio Equipment Co., South Bend, Ind., J. H. Sunderlin.

A. A. Schneiderhahn Co., Des Moines, Iowa, A. A. Schneiderhahn.

Southern Equipment Co., San Antonio, Tex., E. Chaney.

Straus-Bodenheimer Co., Houston, Tex., D. H. Straus.

Watkins-Cottrell Co., Roanoke, Va.

Witte Hardware Co., St. Louis, Mo., R. C. Houck.

Frank W. Wolf, Inc., Buffalo, Frank W. Wolf.

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# Why Choose

# BEST PROFITABILITY?



Westinghouse

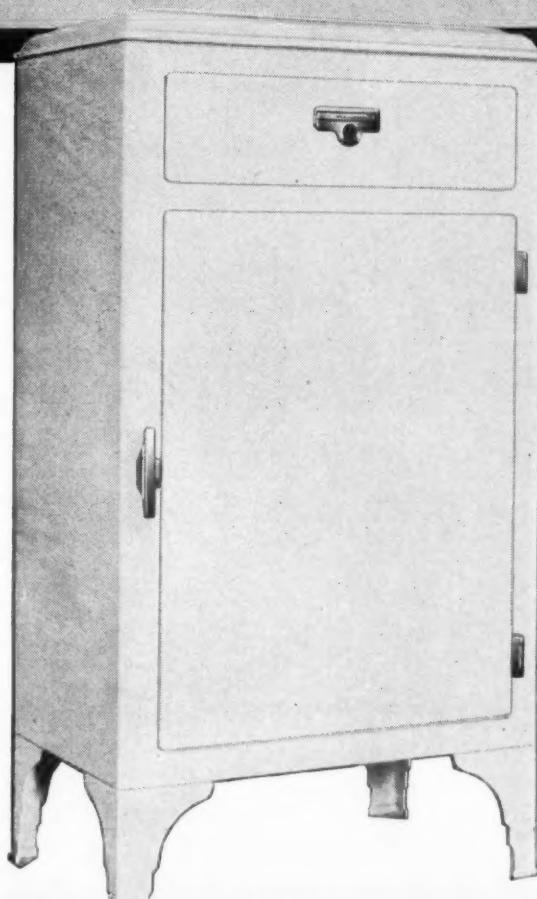
Refrigerator  
FRANCHISE

COMPARISON CHART

CHECK THESE 100 QUESTIONS



LET THE FRANCHISE COMPARISON CHART  
Be Your Guide. You Can Find in it Every Answer to Profit in 1934



• A guide that's honest, accurate and *fair!* A straightforward answer to every question! That's what refrigerator dealers everywhere are finding in the Franchise Comparison Chart! That's why it's so valuable in laying plans for a profitable 1934!

Here, in 100 questions of vital importance, is the opportunity to compare the net worth to you of every refrigerator franchise you may be considering. Compare product . . . sales opportunity . . . reputation of manufacturer . . . advertising and sales promotion assistance . . . and every other point which may add up to your profit or loss. Do this without favor or prejudice . . . free from outside selling pressure . . . in the privacy of your own office.

When you are through, we believe you will agree with us that no other franchise compares with Westinghouse in the unlimited opportunity for clean profits . . . with service worries banished . . . and repeat business assured from the friends and relatives of satisfied customers. In any event, why not send for the Franchise Comparison Chart today, on the coupon below or your own letterhead? It will cost you nothing to obtain this simple "road map" to 1934 refrigeration profit . . . and it may save you many an expensive "detour."

### MAKE AMAZING COMPARISONS LIKE THESE!

Few refrigerator manufacturers have been in business as long as the Westinghouse Electric & Manufacturing Company.

No other refrigerator manufacturer can prove as high a percentage of loyal and satisfied customers among its owners as Westinghouse.

Westinghouse has consistently surpassed its previous year's sales record in each year during the "depression period" of 1930-1933 inclusive.

You will find many interesting comparisons like these possible with the Franchise Comparison Chart. Get the facts!

# Westinghouse

The most valuable Refrigerator  
Franchise in the Industry



Mail  
Coupon  
Now!

Westinghouse Electric & Mfg. Co.,  
Refrigeration Division (ERN-1-24),  
Mansfield, O.

The Franchise Comparison Chart sounds interesting to me. Send me a free copy without obligation on my part.

Name.....

Address.....

City..... State.....

## OPINIONS

(Concluded from Page 2, Column 5) covering of smaller points be more complete.

We are entering the 1934 selling season with much higher hopes than we have possessed in the past three years and we confidently look forward to increasing our refrigeration volume at least 35 per cent over that of 1933.

For some time now, there has been no question in my mind that the country is definitely "on its way out" and for the first time since the advent of the depression the general public seems to feel the same way about it. I have recently observed several "signs" which seem to be unmistakably point that way; one will be sufficient to illustrate.

I have in mind one of the utilities located in one of the larger points in our territory. This company, in December, I understand, received re-installation of electric service requests from over 900 consumers who, during the past four years, had discontinued same!

Does that not look like a pretty good indication of returning confidence? Depressions are caused by an absence of confidence and are "cured" when there is a return of this quality in the hearts of men.

GEO. H. LEHLEITNER.

### Dealers Should Handle Only 1 Line—Barbour

Wisconsin Sales & Supply Co. Westinghouse Refrigerator Milwaukee, Wis.

Jan. 15, 1934.

Editor:

Our experience in selling refrigerators in 1933 was very satisfactory. The first two months of the year were difficult and disturbing ones, but after the bank crash our business improved tremendously and much to our surprise our business in September and October was above our anticipation.

Our dealer policy has always been to have accounts selling the Westinghouse refrigerator exclusively and to increase our coverage each year. We are of the opinion that a dealer cannot sell a new Ford and a new Chevrolet from one sales floor, and the same is true of refrigerators.

We believe that household refrigerator sales will increase with the increase in business and we are looking forward to a very profitable business in the next few years.

Commercial refrigeration offers great possibilities. This is especially true in the tavern field, where the

### Tavern Prospects



R. W. BARBOUR

percentage of taverns equipped is very small, as the financing companies would not discount the paper because of the prohibition law.

For example, in Milwaukee we have 3,000 tavern prospects for commercial refrigeration. As soon as the competition adjusts itself and the strong taverns begin to make money, we look for steady improvement in this business.

R. W. BARBOUR.

### Profit Possibilities Proved—Glasser

Bruno-New York, Inc. Gibson Electric Refrigerators 460 West 34th St., New York City Jan. 12, 1934.

Editor:

Present conditions indicate that 1934 will prove to be an outstanding year for electric refrigeration. I predicate the above on the following factors:

1. The year 1933 proved for the first time to many electric refrigerator distributors that this business can be profitable. A genuine effort had been put forth by distributors in merchandising electric refrigerators in 1933.

Distributors now fully realize that a sizeable volume is possible. They will, therefore, enter the 1934 season with added determination to back refrigeration to the limit.

2. The new administration in Washington has done much to re-establish public confidence. While the seeds of the new deal were planted in 1933, they will definitely bear fruit in 1934 in the way of increased purchasing power.

3. When the code for the industry is put into effect, it will tend for the first time in the industry to establish trade practices that are sound and will prove profitable to those who will adhere strictly to its precepts.

4. Because higher prices will prevail and will materially bolster 1934 dollar volume, even if the industry sells no more units than it did in 1933.

5. Increased dollar sales will enable dealers to maintain sales organization at a minimum of turn-over because the net commission per box payable to retail salesmen will be considerably higher than it was in 1933. It, therefore, appears certain that the earnings of the average retail salesman will be greatly increased.

After all, he is the most important man in the picture and if the industry offers increased earning possibilities, there is certain to be a great desire on the part of retail salesmen to push electric refrigerators.

6. Combination of all the above factors will have a direct bearing on the retail dealer. The average dealer is now more than ever convinced that electric refrigeration business offers him possibilities of increasing his total volume of business and the existence of the NRA codes will afford him also a greater reward for his efforts because of the minimum chiseling and price cutting that will prevail.

And in the final analysis, we have the manufacturer who is responsible for the product. Electric refrigeration has public acceptance. The need for the product is obvious. The public, in purchasing electric refrigerators, expects to get an efficient, trouble-free, and economical refrigerator at a fair price.

I am sure that the 1934 merchandise will meet these requirements and in addition, the industry possesses all of the other prime requisites which should make for a very successful year.

HAROLD A. GLASSER,  
Manager, refrigeration division.

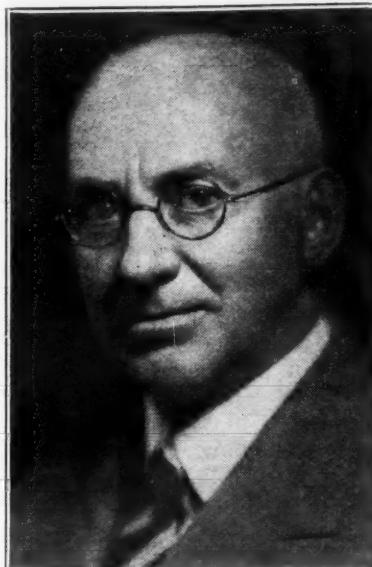
### Fewer 'Chiselers' Will Help Sales—Myers

Walter C. Myers Co. Servel Commercial Refrigeration 311 Third Ave., No., Minneapolis Jan. 16, 1934.

Editor:

Parallel with every other department of our business, our electric re-

### Business Better



WALTER C. MYERS

frigeration division in 1933 was dis-

appointing. The year got off to a bad start. The bank holiday added more gloom and fear to the situation, and as this is a section of the country where the sale of refrigeration is rather seasonal, there was no stampede of spring and early summer business.

When the NRA was established, confidence was somewhat restored but too many of our prospects decided to postpone buying until another year.

The worst trouble we have had to contend with in the past is "chiseling" in both price and terms, but two of the worst offenders have folded up and are now out of the picture.

By comparison, the outlook for 1934 business is very encouraging. There is every indication that the New Deal has broken the back of Old Man Depression. There is less unemployment, there are more and bigger payrolls, the purchasing power of the farmer (and this is truly an agricultural section), is greatly enhanced.

Codes for fair competition will soon get to working which will banish the "chiseler" from our midst—all of which paves the way to a more profitable business for 1934.

Our business started off with a bang immediately after Jan. 1 and the first half of the month is well over 50 per cent greater than for the same period last year. We have larger and better prospect list and merchants generally are more encouraged.

We are encouraged by these changing conditions. We are confident that we understand our business better than a year ago and that we may profit by some blunders made in the past.

We are grateful for new and improved models coming out and that the company is backing us up 100 per cent. I am especially enthusiastic in the belief that before the end of this year, the imp of fear in the minds of so many people will quietly fold its tent and silently steal away.

WALTER C. MYERS.

### Average Incomes to Form 1933 Market—Huston

H. R. Huston Co. Universal Domestic and Commercial Refrigeration 124 E. Long Ave., New Castle, Pa. Jan. 15, 1934.

Editor:

The year 1933 was very gratifying to the most of us, because it was vastly better than 1932. The majority of refrigeration distributors are no doubt very optimistic about the coming year.

They have a right to be, for in our opinion, 1934 should be the best year the industry has seen thus far, that is provided economic conditions continue to improve at their present rate.

Of course, domestic sales will show a sharp gain, for the public is fast becoming refrigeration minded. Public acceptance thus far, will have a far reaching effect in breaking down future sales resistance.

I believe that the volume this year will come largely from the home with an average income. Refrigeration is no longer considered a luxury by those of moderate means, as it was a few years ago.

It is my prediction that the commercial refrigeration business in 1934 will far exceed the fondest expectations of everyone in the industry. Commercial equipment that was sold back in the late twenties has become obsolete. That applies not only to the small machine but ammonia jobs as well.

The evaporators are so inefficient compared to the present equipment, that the owners are beginning to realize that new equipment will reduce their overhead through savings in cost of operation. Capacities of condensing units have been increased through increased efficiency in design and engineering principles.

I recently went into a butcher shop to talk, or rather sell a commercial unit. The owner informed me, that if I came in to talk refrigeration to him, that I was only wasting my time and his also. He wasn't even interested, he wasn't going to buy one, and he wanted me to clearly understand that.

In other words he did about everything else but throw me out for even mentioning the fact.

It so happened that I knew that his present equipment was obsolete and breaking him up when it came to operating costs, but he wouldn't admit it. Less than 30 days after that first interview, I had his order for \$1,350 worth of new equipment.

I don't mention this through any egotism on my part, but there are perhaps thousands of obsolete jobs that could easily be replaced with new equipment with the proper effort.

Air conditioning will contribute largely to increasing commercial volume in 1934. While it is new to the most of us now, I believe that within a few years you will find it in the majority of the better class homes.

While the repeal of the eighteenth amendment last year and the return of beer did not bring as much business as some had anticipated to the refrigeration industry, the coming year should show a marked increase in the use of mechanical refrigeration for that purpose.

Taking everything into consideration 1934 will reward those that go after the business.

J. H. HUSTON,  
Vice president.

### Good Dealers



C. L. CARPER

### Carper Reports Good January Deliveries

Sidles-Duda-Myers Co. Grunow Electric Refrigerators Lincoln, Neb.

Jan. 15, 1934.

Editor:

We had a very satisfactory and profitable volume of electric refrigeration business during the 1933 season. We introduced a new line in 1933 which had wonderful acceptance from the dealer as well as the consumer.

We built up a very fine dealer clientele, and on account of their unusual success we expect to increase our dealer set-up at least 100 per cent in 1934.

In our own particular territory we expect to see a large increase in sales of electric refrigeration over 1933. The main reason for this is conditions are so much better than a year ago, especially the earlier part of 1933.

We enjoyed the best radio business that we have had since 1930 and sold more battery sets during the past season than we had in the last three years. As we operate wholly in an agricultural section this proved that the farmer was in much better position to purchase than anytime for several years.

Our January deliveries of electric refrigeration to the dealer are unusually good and we cannot help but believe that 1934 is going to be a wonderful year for us in all lines.

C. L. CARPER,  
Vice president.



### Always

Regardless of time, place or season, Oil Burners, Refrigerators and Air Conditioning Equipment must respond automatically to the needs or wishes of the user. For that reason manufacturers, distributors and dealers in this and similar motor-driven apparatus have for years relied on the continuous dependability of Century Motors the world over. • 1/250th to 600 h.p.

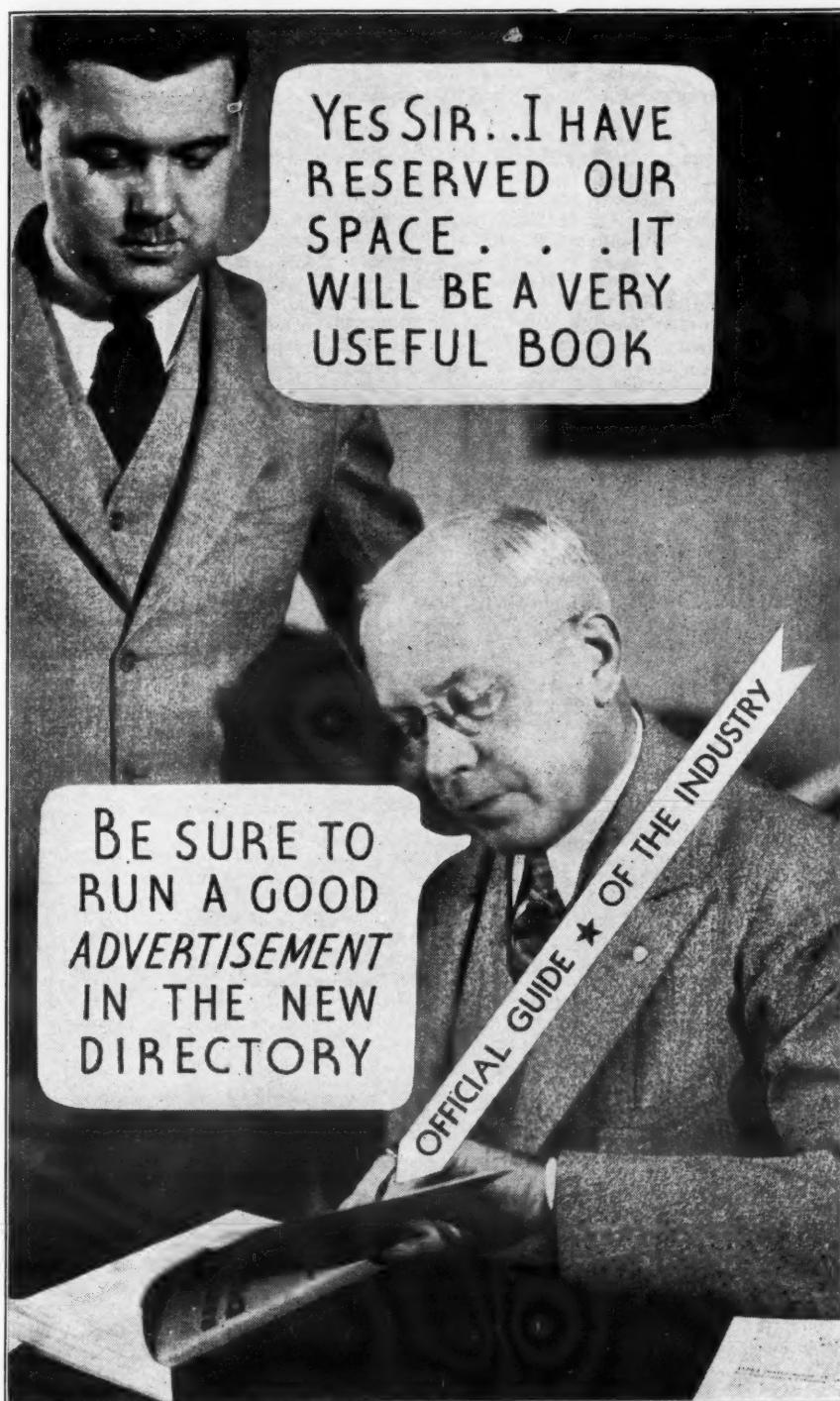
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THIS Directory will be the industry's accepted Buying Guide and Reference Medium for the next twelve months.

It will reach your present and potential customers both in this country and abroad.

*Your advertisement in it will talk for you to prospects you would be unable to reach in any other way.*

In addition to its use by manufacturers, the Directory will be constantly referred to by large distributors and dealers interested in new lines, related merchandise and replacement parts.

The foreign circulation of the Directory will be particularly valuable to advertisers. A copy will go to every American consular office in foreign countries. Your sales message placed at this point of inquiry for potential foreign buyers will bring you many opportunities for export business.

# LAST CALL

**Send in your  
advertisement today  
for the 1934 Directory**

**T**HREE are only a few days left before the first forms of the new 1934 Refrigeration Directory and Market Data Book goes to press.

Most of the leading manufacturers have already reserved advertising space. They have made sure that their sales messages will always be a part of the information derived from the Directory when it is used by prospective customers.

If you miss this issue of the Directory, the opportunity will not be available for another year, for there will be no other similar book published before 1935.

Make sure of your contact with the refrigeration business this year. It will probably be the biggest year the industry has ever seen.

Reserve your space today while there is still time. The advertising rate is only \$100 per page. First forms will close February 1.



**BUSINESS NEWS PUBLISHING CO.**  
550 Maccabees Bldg., Detroit, Mich.



## ELECTRIC REFRIGERATION NEWS

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The Newspaper  
of the Industry



Written to Be  
Read on Arrival

Published Every Week by

### BUSINESS NEWS PUBLISHING CO.

Also publishers of REFRIGERATED FOOD NEWS (monthly) and REFRIGERATION DIRECTORY AND MARKET DATA BOOK (annual) 550 Maccabees Building, Woodward Ave. and Putnam St. Detroit, Michigan. Telephones: Columbia 4242-4243-4244-4245

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VOL. 11, NO. 4, SERIAL NO. 253, JANUARY 24, 1934

## Selecting Media

**A**PPROPRIATIONS for national advertising on the part of electric refrigerator manufacturers are, for the most part, larger this year than they were last. Even so, it appears that fewer magazines will carry refrigeration advertising in 1934 than in any of several previous years.

Tendency this year is to concentrate. A regular page-every-issue campaign in one good magazine, advertising managers are reasoning, should be considerably more effective than the same number of pages scattered through four or five different magazines. Whether or not this line of reasoning is sound remains to be seen; but most advertising departments in the industry seem to be following it.

On what basis are the Chosen Few magazines selected? For the most part, those which can present the heaviest assemblage of data, the biggest charts, and the most complete circulation breakdowns seem to be getting the call. Editorial content, and use by other refrigeration advertisers, also count.

Some tongue-in-the-cheek advertising agency men will tell you that cynical old rule: "Find out what magazines the client reads, and then place his advertising in them" still holds. But only a few. Most agency men are on a constant hunt for statistics with which to prove their case.

Men from other industries are wont to give the credit to heavy promotional campaigns for the success of electric refrigeration. If this be true, it would appear that the industry is headed for still greater heights; because 1934 will show even greater, and possibly smarter, promotional efforts than have been put forth in previous years.

## Home Service

**F**ACTORY executives, in announcing their plans for selling activities in 1934, have made little reference to home service programs for the new season. Apparently, however, they will sponsor home service work on a larger scale than ever before, making it a major cog in their sales promotion mechanism.

In 1933, some of the largest refrigeration manufacturers placed increased emphasis on home service, and reported that the results it produced were very satisfactory. For the first time, Kelvinator home economists were admitted as contestants in the company's annual "Derby." Westinghouse' home service department cooperated with Kroger Food Foundation in a series of elaborately staged cooking schools featuring movies in which Westinghouse economists demonstrated proper use of electric refrigerators and ranges.

Activities of General Electric Co.'s home service department were expanded to encompass all-electric kitchen promotion. Frigidaire Corp.

increased the scope of its home service activities, too. In addition to issuing new publications on cold cookery, Verna Miller, Frigidaire economist, prepared a complete "key to meal planning," a household help around which much of the company's midsummer advertising was built. Late in 1933, Norge Corp. set up a home service department under direction of Mary Elizabeth Appel.

At A Century of Progress in Chicago last summer, home economists played an important role in acquainting the public with the refrigeration products of their respective manufacturers. Jean Adair directed daily cold cooking demonstrations in the Frigidaire display, as did Miss Appel for Norge. Westinghouse home service women, with a corps of assistants, gave regular demonstrations of electric household appliances. Featured in G-E's exhibit was a talking all-electric kitchen, attended by home service representatives. And in August alone, Ruth Wiswell—home economist for L. C. Wiswell, Inc., Chicago Kelvinator distributor—conducted 55 demonstrations at the Kelvinator display before a total of 11,950 persons.

Now, with the heavy selling season approaching, manufacturers are planning home service activities on a larger scale than ever before. Norge Corp. has added a new member to its home service department, and is preparing an ambitious program for instructing its distributors in the use of home service work. Edna I. Sparkman, director of Westinghouse refrigerator home economics, is planning to center increased attention upon department store promotional activities, and on training distributor economists.

This week, the entire factory and field staff of Kelvinator economists is in session at the factory in Detroit, studying 1934 plans. More than 60 women, representing utility companies, distributorships, and the Kelvin Kitchen traveling staff, are attending the conference, which is the first of its kind in Kelvinator's history. According to Pauline Peacock, newly appointed Kelvinator home service director, the factory's permanent kitchen staff is being enlarged, and the field force doubled.

General Electric's home service staff, headed by Edwin Nolan, is making a study to determine the relationship of home economics demonstrations to actual sales, as a basis for this year's operations. New model and laboratory kitchens at the General Electric Institute in Cleveland have been opened to provide better facilities for study of kitchen problems.

These developments seem to indicate that some manufacturers place a good deal of confidence in home service work as an effective sales promotional activity, and that it will play a significant part in refrigeration merchandising in 1934.

## WHAT OTHERS SAY

### Price Fixing Out

**G**ENERAL JOHNSON apparently has very positive ideas on "arbitrary price fixing on the products of an individual manufacturer by a jury of his competitors." This comment from him came in the Nema code hearing when a price fixing amendment was submitted. As a matter of policy and considering both the interests of the public and the manufacturers, we also believe the proposed amendment should be rejected. Aside from the very difficult factual determination of what constitutes a fair price, it is a sound principle of business that progress results from fair competition and not from price agreements.

Under the code permission is given to do two things that prevent unfair price competition. The first is the provision that no manufacturer shall sell below cost. This provision needs clarification both as regards exceptions and as regards the method for ascertaining costs. The second is the provision that permits prices and discounts to be published and the enforcement of these prices for current order solicitations. This provision prevents price cutting for a given order. It also needs clarification and strengthening as well as a more direct mechanism to get enforcement. But if the Nema code authority uses these two provisions intelligently there is no doubt that present business practices will be improved. Until these clauses are put into operation, however, there is no necessity for price fixing.

It is apparent from the hearing to date that instead of getting more powers than Nema authorities desired they are more apt to get modifications desired by labor and the government. Labor demands have already been made at the hearing which, if granted, will cause a serious increase in expenses and complicate code operations. The electrical manufacturers obtained more in their initial code than perhaps any other industry. It should have been put into operation before attempts were made to get more power or privileges granted by the administration in Washington. *Electrical World*, Jan. 13, 1934.

## 6 Manufacturers Spend \$853,156 for Space In Magazines

(Concluded from Page 1, Column 2)  
tising among the publications with receipts amounting to \$402,055.20 or about 47 per cent of the total.

Following is a record of the amounts spent by the six manufacturers and a list of the publications used by each. The expenditures are for household electric refrigeration except when otherwise indicated.

### Crosley Radio Corp.

(Crosley Refrigerator with Shelvador)  
Saturday Evening Post ..... \$11,905.20  
McCall's ..... 10,399.20  
Hearst's-Cosmopolitan ..... 2,322.00  
American Magazine ..... 2,304.00  
Ladies' Home Journal ..... 1,944.00  
Woman's Home Companion ..... 1,836.00  
Liberty ..... 1,404.00  
Collier's ..... 1,134.00  
Good Housekeeping ..... 954.00  
The New Yorker ..... 453.60  
Total ..... \$34,656.00

### Frigidaire Corp.

(Frigidaire Refrigerator)  
Saturday Evening Post ..... \$76,050.00  
Household ..... \$76,050.00 ..... \$107,100.00  
Commercial ..... 31,050.00 ..... \$107,100.00  
Collier's ..... 57,500.00  
Good Housekeeping ..... 33,600.00  
Woman's Home Companion ..... 32,700.00  
Better Homes & Gardens ..... 19,200.00  
Time ..... 3,445.00  
Fortune ..... 2,000.00  
The New Yorker ..... 1,700.00  
Business Week ..... 1,110.00  
Total ..... \$258,355.00

### General Electric Co.

(General Electric Refrigerator)  
Saturday Evening Post ..... \$124,200.00  
Good Housekeeping ..... 25,200.00  
Ladies' Home Journal ..... 17,100.00  
Hearst's-Cosmopolitan ..... 8,400.00  
Collier's ..... 5,100.00  
American Magazine ..... 4,500.00  
Better Homes & Gardens ..... 2,700.00  
National Geographic ..... 2,470.00  
House & Garden ..... 1,800.00  
Literary Digest ..... 1,600.00  
Time ..... 1,025.00  
Fortune ..... 880.00  
Total ..... \$194,975.00

### Grigby-Grunow Co.

(Majestic Refrigerator)  
Saturday Evening Post ..... \$28,800.00  
Total ..... \$28,800.00

### Kelvinator Corp.

(Kelvinator Refrigerator)  
Saturday Evening Post ..... \$90,900.00 ..... \$101,250.00  
Commercial ..... 10,350.00 ..... \$101,250.00  
Collier's ..... 55,100.00  
Good Housekeeping ..... 39,200.00  
McCall's ..... 38,400.00  
Ladies' Home Journal ..... 33,750.00  
Better Homes & Gardens ..... 6,400.00  
Literary Digest ..... 4,800.00  
Time ..... 2,920.00  
Nation's Business (Commercial) ..... 950.00  
Total ..... \$282,270.00

### Leonard Refrigerator Co.

(Leonard Electric Refrigerator)  
Saturday Evening Post ..... \$28,800.00  
Good Housekeeping ..... 15,000.00  
Collier's ..... 5,000.00  
Literary Digest ..... 4,800.00  
Total ..... \$53,600.00

## Commercial Case Code Authority Chosen

CHICAGO—A code authority for the commercial refrigerator industry consisting of seven members from the industry and one from the NRA was appointed at a meeting held here Jan. 12 under the auspices of the Commercial Refrigerator Manufacturers' Association.

The code authority consists of the following members:

H. C. Ahrens, C. Schmidt Co.; R. E. Frederick, Standard Refrigerator Co.; C. F. Garland, Garland Refrigerator Co.; W. T. Sherer, Sherer-Gillett Co.; R. H. Starr, Koch Butchers Supply Co.; H. M. Stewart, McCray Refrigerator Sales Corp.; V. P. Warren, The Warren Co.; William Lawson, assistant deputy administrator.

The executive committee of the association appointed Paul H. Sullivan secretary of the association, with offices at 111 W. Washington St., Chicago.

## Valves & Fittings Firms Complete Association

PITTSBURGH—Leading manufacturers of refrigeration valves, manifolds, and fittings have completed the Refrigeration Valves & Fittings Manufacturing Association to operate in compliance with the terms of the National Industrial Recovery Act.

J. S. Swensson has been appointed secretary of the association, with offices at 604 Bank building, Pittsburgh.

Members have subscribed to the basic code of wages and hours of the fabricated metal products industry, and the association is seeking approval of a supplementary code of fair trade practices for the refrigeration valves and fittings industry.

## Auditorium Licenses Companies Bulding Conditioning Units

(Concluded from Page 1, Column 5)  
such unit air conditioners to anyone with restriction or further royalty payments to the Auditorium Conditioning Corp.

For collecting royalties on Auditorium patents used in central station air-conditioning systems, a number of special agents have been appointed throughout the country. These special agents are experienced heating and ventilating contractors who, in the opinion of Auditorium officials, have the training and the organization necessary to design and install complete systems.

Special agents are authorized to take a complete job for a fixed royalty, paid once. This royalty is a comparatively small percentage of the contract, and entitles the purchaser of the license to use any of the Auditorium patents. Agents may purchase the component equipment from reputable manufacturers; and the royalty payment remains the same regardless of how many patents or different systems are used.

Under this plan, the architect or owner of the license is not compelled to use Auditorium patents on all installations. He may use them freely on one installation, and the royalty is collected from that one installation. On another installation he may use a system that does not come within the scope of Auditorium patents, and he pays no royalty on that installation.

In giving reasons for the company's formation, and explaining its business, officials of the organization say:

In the past, the air-conditioning "patents outstanding, and the patent applications known to be pending made selection of a particular system, or of the good points of many systems for one installation, an almost hopeless task.

"Many realized they had to go to some one company and confine themselves to laying out systems on which that company could protect them from litigation. It of course tied the architect to that one company as a supplier of the system. But, a reliable company would not guarantee a man against patent litigation if he deliberately infringed a valid patent. Therefore, it became necessary to 'avoid' patents.

"An architect feels that he should provide competition for his client, and the owner feels that he should have the protection of competitive bids, especially where systems are to be laid out by architects and engineers, and where much of the cost is represented in installation work.

"The problem remained as to how this could be done and still retain the right to utilize the worthwhile improvements which had been made or would be made in the future.

"Solving this problem is the purpose of the Auditorium Conditioning Corp., which has been engaged for several years in marketing talent and sources of development in air conditioning. It has acquired rights to many systems and apparatus. It will continue to sort and select worthwhile developments in the future.

"The company has adopted a licensing plan which places these inventions and improvements at the disposal of the public. They may now be obtained without architect or owner being required to confine his dealings to any one manufacturer or contractor."

## Sunbeam Subsidiary to Sell Refrigerators

(Concluded from Page 1, Column 1)  
area storage space. A nine-stage cold control is directly above, on the exterior of the cabinet. Other features include interior electric light, trigger latch, and sliding fruit basket.

"L" models have a Dulux exterior finish, while deluxe models have a porcelain exterior. Insulation is 2 in. on the L-432 and L-526 models, and 3 in. on the others.

Model L-432 has a net food storage space of 4.32 cu. ft. and a shelf area of 9.27 sq. ft. Overall height (including legs) is 50% in. Freezing unit makes 63 cubes, or 4 1/4 lbs. of ice.

Model L-526 has a net food storage space of 5.26 cu. ft. and a shelf area of 10.49 sq. ft. Overall height is 53% in. Freezing unit makes 63 cubes, or 6 lbs., at one freezing. Deluxe 526 has the same specifications, with porcelain exterior.

Model L-628 has a net food storage capacity of 6.28 cu. ft., and a shelf area of 12.77 sq. ft. Overall height is 56 in. Freezing unit makes 112 cubes, or 8 lbs. of ice, at one freezing. Deluxe 628 is identical, but has porcelain exterior.

Only two-door model is Deluxe 856, which has porcelain exterior, net food storage capacity of 8.56 cu. ft., shelf area of 16.57 sq. ft., makes 140 cubes, and is 56 in. high.

## ENGINEERING

### Stewart-Warner Puts Fins on Compressor to Reduce Temperatures in Head

(Continued from Page 1, Column 5)  
concealed hardware and black legs, short and massive. There is no name-plate on these models, the manufacturer's name being stamped on the slender door latch.

Evaporators on the deluxe refrigerators are centered, and have chrome-finished doors, hinges of which may be snapped off the evaporator shell and clamped on the opposite side to give the door a right or left swing, as desired.

Eye-catcher of the deluxe models is their rolling shelves. Edges of the shelves rest between, not on, grooved rollers. These shelves may be pulled outward easily, and come to a stop when a metal clasp catches on one of the shelf support bars.

By flipping this clasp up and over, a shelf may be removed and used as a tray—there being a protecting wire arrangement on all sides. Height of any shelf may be changed, without removing it, by removing each corner of the supporting bars up or down.

Smallest model in the standard line is 454, with a net food storage capacity of 4.6 cu. ft., priced at \$129.50 f.o.b. factory. Selling at \$169.50 is model 554, with a 5.6-cu. ft. capacity. Largest of this line is model 704, with a 7.1-cu. ft. storage space, selling for \$197.50. All of these refrigerators are finished in lacquer—"Porceloid" made by Chicago's Bradley-Vrooman Co.

Lowest-priced models in the deluxe line are also finished in this lacquer. First is model 564-A, having a 5.6-cu. ft. net capacity, priced at \$219.50 f.o.b.

factory. Model 714-A, with 7.1 cu. ft. of storage space, sells for \$244.50, and model 834-A has 8.3 cu. ft. of space, and is priced at \$264.50.

Also in this line are three other models which are the same as the "A" models in construction and specifications, but are all-porcelain. Their prices: 564-AP, \$244.50; 714-AP, \$269.50; 834-AP, \$295.00.

When production on its lacquer and porcelain refrigerators is well under way, Stewart-Warner will make a refrigerator with a cabinet of Monel metal. It will probably be made in one size only, and its price has not been determined, according to Mr. D'Olive. The company has a Monel model on display at the factory for examination by distributors.

One change evident in the compressor of the new refrigerators is the large amount of finning to reduce temperatures in the head. Another change made is one which keeps the crank shaft flooded with oil at all times, reducing the possibility of the shaft seal running dry.

To insure proper lubrication of the cylinder walls, use is made of a novel float on either side of the pistons, with a wide oil groove. On the side of the compressor body, where the oil block is located, is attached a gauge rod for checking the oil supply. This feature follows Stewart-Warner's experience in automotive engineering.

The bedplate on which the compressor and motor are mounted is equipped with legs which permit a service man to set the entire condensing unit

assembly on the floor without danger of its tipping over and putting the entire load on the flywheel.

By removing two screws at the back of the cabinet, the condensing unit can be lifted out of the cabinet without opening up any tubing connections. Cold control bulb is inserted in the thermometer well which extends into the refrigerant in the evaporator. The latter is of the flooded type, controlled by a low side float.

In Stewart-Warner's porcelain this year, an inner shell is placed over the cabinet frame, and the porcelain shell is placed over that. Back of the compressor compartment in deluxe models is covered with metal lath to improve the cabinets' appearance.

Hinges of deluxe models embody a spring-driven plunger which is inserted in the hinge strap. This plunger operates on a short lever arm, and is in contact with the hinge for approximately 45 degrees of the opening arc, thus giving the door a smooth outward swing when the door latch is touched.

By pushing upward on a button located on the under side of the door latch, the food compartment door becomes locked. When the button is pulled down, the feather-touch mechanism is put in a position to open the door when pressure is applied on the latch.

Stewart-Warner distributors, many of whom are newly franchised, are visiting the factory in small groups to see the new refrigerator models and discuss sales plans. First group was in Chicago Jan. 15 and 16, the second visited on Jan. 18 and 19, and others will come at intervals until Feb. 1.

At the conference last Thursday and Friday, distributors first made a study of the refrigerators and the factory's production setup. On the second day, they discussed sales and advertising plans, which were presented by Mr. D'Olive, Fred Cross, advertising manager, and A. B. Dicus, assistant advertising manager.

One thing on which Mr. D'Olive will hammer constantly during 1934, with (Concluded on Page 8, Column 1)

### Stewart-Warner Specifications

Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, Ill.

| Model No. | Standard    | Deluxe         |
|-----------|-------------|----------------|
|           | 454 544 704 | 564A 714A 834A |

#### Cabinet Specifications

| Overall dimensions (in.) | 55 $\frac{1}{2}$ | 60 $\frac{1}{2}$ | 61 $\frac{1}{2}$ | 58 $\frac{1}{2}$ | 59 $\frac{1}{2}$ | 62 $\frac{1}{2}$ |
|--------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Height                   | 55 $\frac{1}{2}$ | 60 $\frac{1}{2}$ | 61 $\frac{1}{2}$ | 58 $\frac{1}{2}$ | 59 $\frac{1}{2}$ | 62 $\frac{1}{2}$ |
| Width                    | 23 $\frac{1}{2}$ | 25 $\frac{1}{2}$ | 30               | 25 $\frac{1}{2}$ | 30               | 31 $\frac{1}{2}$ |

#### Inside dimensions of liner (in.)

| Height | 27 $\frac{1}{2}$ | 30 $\frac{1}{2}$ | 31 $\frac{1}{2}$ | 30 $\frac{1}{2}$ | 31 $\frac{1}{2}$ | 34 $\frac{1}{2}$ |
|--------|------------------|------------------|------------------|------------------|------------------|------------------|
| Width  | 19               | 20 $\frac{1}{2}$ | 23 $\frac{1}{2}$ | 20 $\frac{1}{2}$ | 23 $\frac{1}{2}$ | 25 $\frac{1}{2}$ |
| Depth  | 16 $\frac{1}{2}$ | 16 $\frac{1}{2}$ | 17 $\frac{1}{2}$ | 16 $\frac{1}{2}$ | 17 $\frac{1}{2}$ | 17 $\frac{1}{2}$ |

#### No. of doors

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|

#### Storage Capacity

| Gross food storage capacity (cu. ft.)             | 5.1 | 6.2 | 7.5             | 6.2             | 7.5             | 8.7             |
|---|-----|-----|-----------------|-----------------|-----------------|-----------------|
| Net food storage capacity (cu. ft.) (Nema rating) | 4.6 | 5.6 | 7.1             | 5.6             | 7.1             | 8.3             |
| Number of shelves                                 | 3   | 3   | 3 $\frac{1}{2}$ | 3 $\frac{1}{2}$ | 3 $\frac{1}{2}$ | 4 $\frac{1}{2}$ |

| Total shelf area (sq. ft.) (Nema rating) | 9.3 | 10.5 | 13.4 | 11.3 | 13.4 | 17.1 |
|--|-----|------|------|------|------|------|
|  |     |      |      |      |      |      |

#### Ice Cube Trays

| No. of trays                 | 2               | 3               | 3               | 5               | 5               | 6               |
|------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| No. of cubes produced        | 56              | 84              | 84              | 77              | 77              | 105             |
| Weight of cubes (lbs. total) | 4 $\frac{1}{4}$ | 6 $\frac{1}{2}$ | 6 $\frac{1}{2}$ | 5 $\frac{1}{2}$ | 5 $\frac{1}{2}$ | 7 $\frac{1}{2}$ |

#### Thickness of Insulation (in.)

| Top   | 2               | 3               | 3               | 3               | 3               | 3               |
|-------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Sides | 2               | 2 $\frac{1}{2}$ | 3               | 2 $\frac{1}{2}$ | 3               | 3               |
| Door  | 2 $\frac{1}{2}$ | 3               | 3 $\frac{1}{2}$ | 3               | 3 $\frac{1}{2}$ | 3 $\frac{1}{2}$ |

#### Compressor Specifications

| Compressor capacity (lbs.) I.M.E. (5° F-86° F.) | 155             | 155             | 155             | 155             | 155             | 155             |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Motor size (hp.)                                | 3 $\frac{1}{2}$ |
| Compressor speed r.p.m.                         | 375             | 375             | 375             | 375             | 375             | 375             |

#### Prices (f.o.b. factory)

| Lacquer models (A)    | 129.50 | 169.50 | 197.50 | 219.50 | 244.50 | 264.50 |
|-----------------------|--------|--------|--------|--------|--------|--------|
| Porcelain models (AP) |        |        |        |        | 244.50 | 269.50 |

#### \* \* \*

#### Cabinet Materials

|                                  |             |                                       |                        |
|----------------------------------|-------------|---------------------------------------|------------------------|
| Make of cabinet                  | Rex         | Control                               | Penn                   |
| Material used for frame          | Steel       | Type of control                       | Temperature            |
| Finish of shelves                | Hot treated | Temperature regulation method         | Manual                 |
| Materials used for breaker strip | Tyloc       | How defrosted                         | Wide cycle on          |
| Material used for gasket         | Rubber      | Standard and semi-automatic or Deluxe | Type of ice cube trays |
| Make of gasket                   | Miller      | and Flexo                             |                        |
| Make of insulation               | Balsam Wool |                                       |                        |

#### Finish

|                           |            |                |         |
|---------------------------|------------|----------------|---------|
| Cabinet finish (exterior) | Lacquer or | Control        | Penn    |
| Cabinet finish (interior) | Porcelain  | Type of system | Flooded |

#### Evaporator

|                         |               |                    |                |
|-------------------------|---------------|--------------------|----------------|
| Make of evaporator      | Mullins       | Compressor         | Stewart-Warner |
| Evaporator construction | Pressed steel | Type of compressor | Reciprocating  |
| Metal used              | Steel         | Compressor drive   | twin cylinder  |

#### Hardware

|                      |
|----------------------|
| Make of hardware</td |
|----------------------|

## ENGINEERING

### Advertising to Back Up Stewart-Warner Salesmen in Field

(Concluded from Page 7, Column 3) the assistance of George License, head of the service division, will be establishment of efficient service departments in all distributorships. Said he: "Show me 50 ace-high distributor outlets anywhere, and I'll show you 50 good service operations."

In Stewart-Warner's "Quality Lane," through which visiting distributors are taken to show steps followed in construction of the company's refrigerators, is one section devoted exclusively to service.

In it are blowups and pictorialized explanations of the Stewart-Warner unit's component parts, and a large cabinet stocked with all parts and tools with which a good service department should be equipped.

To start its national sales promotion drive, Stewart-Warner will use national magazine advertising, and while there will not be a great number of advertisements, they will be large in size, explained Mr. Cross.

Largest newspaper advertisements prepared at the factory for use by distributors and dealers will play up features of the new Stewart-Warner refrigerators, with pictures dominating the makeup. In each of the smaller advertisements, a single feature will be emphasized, with others merely listed.

The factory within the next few weeks will sponsor some advertising in key city newspapers in each distributor's territory, to be continued later by distributors, and paid for out of funds accumulated from assessments made by Stewart-Warner on each unit sale to the wholesalers.

Trade paper advertising will play an

the conferences.

Another book being prepared at the factory will be issued to wholesale salesmen for use in talking to prospective dealers. It emphasizes the manufacturer's record and sales experience, the "shortness" of the Stewart-Warner line, its sales features, advertising programs, sales plans and aids, and the factory's service plan.

Mr. D'Olive is insisting that his distributors make every effort to secure department store accounts, as he believes they will make 35 per cent of the industry's total sales this year.

He pointed out that oftentimes a department store will drop a line because a nearby dealer for that line consistently undersells the department store, thus making the latter merely a good showroom wherein prospects see the refrigerator well displayed and demonstrated before they buy from the price cutter.

Manager D'Olive's recommendations for correcting this situation are short and to the point: "Don't lose a good account because of one little 15-units-a-year chisel. Cancel the price-cutter off your list, and keep the big fellow."

At the close of the distributor conferences, the following distributors will have visited the factory.

C. N. Triplett, Baltimore Gas Light Co., 111-112 E. Lombard St., Baltimore.

E. E. Gibbs, Wimberly & Thomas Hardware Co., 2011 First Ave., Birmingham.

S. V. Brooks, Bluefield Hardware Co., 400 Bluefield Ave., Bluefield, W. Va.

A. C. Marquardt, manager, Stewart-Warner Sales Co., 1111 Commonwealth Ave., Boston.

A. H. Brownell, H. D. Taylor Co., 99-117 Oak St., Buffalo.

E. G. Kyle, R. H. Kyle & Co., Charleston, W. Va.

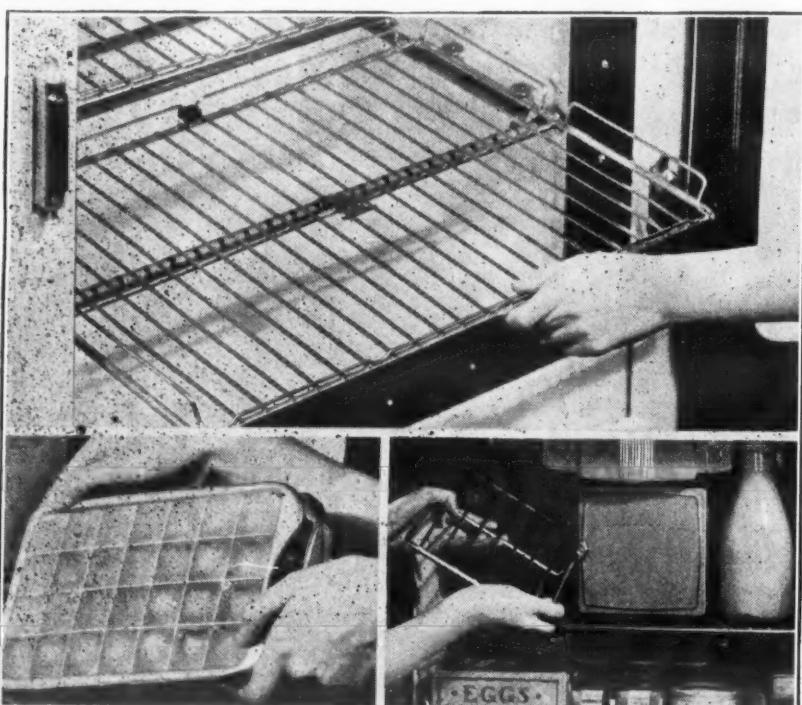
J. Northeim, Southern Bearings & Parts Co., 315 N. College St., Charlotte, N. C.

L. V. Whitney, L. V. Whitney, Inc., 236 E. Erie St., Chicago.

D. Aitken, Sr., Geo. Worthington Co., 802 St. Clair Ave. N. W., Cleveland.

A. C. Humphries, Carolina Wholesale Co., Columbia, S. C.

### Madam, Stewart-Warner Offers --



—rolling shelves (above) which can be removed and used as serving trays; a 28-cube tray (lower left) with a large handle; and a removable shelf for bottle storage (lower right) and a chromium-covered evaporator.

important part in Stewart-Warner's 1934 activities, Mr. D'Olive said.

Several types of merchandising books are being prepared at the factory for its sales organization. One is designed for use by retail salesmen in talking to prospects. On each page appears the admonishment of some home economist to look for a certain feature in buying an electric refrigerator, and below that paragraph is a discussion and picture of Stewart-Warner's provision for that requirement.

Another publication in preparation is for dealers. It gives hints and suggestions on how to demonstrate Stewart-Warner features most effectively, emphasizes the importance of sales presentations in the prospect's home, and gives instructions for best use of direct mail.

Window displays and directions for their use are treated in another section of the book, as are instructions for handling time payments. Recommended methods of "using the user" also form a part of the dealer-hints book.

In the manual is a copy of a new sales instruction book written for retail salesmen. These are on the press now, and will be available shortly, according to Mr. Dicu.

A big new broadside is being furnished distributors for announcing their Stewart-Warner connections to dealers and dealer prospects in their respective areas.

Commercial Investment Trust Corp. will handle deferred payment sales to dealers and retail buyers this year, it is being announced to distributors at

H. T. Welch, Hughes-Peters Electric Corp., 178-180 N. Third St., Columbus, Ohio.

E. W. C. Gierke, Gierke-Robinson Co., 322 W. Fourth St., Davenport, Iowa.

W. Shorb, Field & Shorb Co., Decatur, Ill.

D. C. Dodge, manager, Stewart-Warner Sales Co., 1344 Broadway, Denver, Colo.

H. J. Shaw, manager, Electric Specialties Co., 433 E. Larned St., Detroit.

Albert Marshall, manager, major home appliance division, Marshall-Wells Co., Duluth, Minn.

Ralph Novinger, manager, Stewart-Warner Sales Co., 42-44 N. Cameron St., Harrisburg, Pa.

G. R. Wood, manager, Stewart-Warner Sales Co., 45 Wells St., Hartford, Conn.

Wm. Mooney, Jr., Mooney-Mueller-Ward Co., 501 Madison Ave., Indianapolis.

J. L. Johnson, Treman, King & Co., Ithaca, N. Y.

P. P. Richmond, Alemite Co. of Missouri, 3117 Gillham Road, Kansas City, Mo.

C. A. Roesch, C. A. Roesch Co., 1101 S. Hope St., Los Angeles.

W. H. Terstege, Stratton & Terstege Co., Main at 15th St., Louisville, Ky.

Mrs. E. I. Scott, Miami-Copeland, 1100 W. Flagler, Miami, Fla.

Harry Weber, Alemite Co. of Wisconsin, 921 N. Broadway, Milwaukee.

S. Salzman, Wholesale Radio Equipment Co., 902 Broadway, New York City.

G. H. Bowers, Dix-Bowers Co., Olney Road and Boush St., Norfolk, Va.

H. C. Noll, H. C. Noll Co., 2226 Harvey St., Omaha, Neb.

Carl Markel, Logan-Gregg Hardware Co., 121 Ninth St., Pittsburgh.

J. J. Gravley, Alemite Co. of the North West, 85 N. Tenth St., Portland, Ore.

D. F. Hyland, Stewart-Warner Sales Co., 3227-29 Locust Blvd., St. Louis.

Mr. Moore, Herberts-Moore Machinery Co., 550 Fifth St., San Francisco.

C. A. Hinsdill, Hinsdill Electric Co., River and First Sts., Troy, N. Y.

J. D. Pottenger, Stewart-Warner Products Co., 415 E. Second St., Wichita, Kan.

### Underwriters Test Refrigerants for Hazards Of Toxicity, Decomposition & Flammability

(Continued from Page 1, Column 4) of phosgene, there is a diversity of opinion by different observers regarding the conditions under which it may be formed in appreciable quantity in the presence of flame, particularly from the decomposition of dichlorodifluoromethane and carbon tetrachloride.

The chemical reactions involved in the formation of phosgene by the decomposition of these compounds in contact with flame are complex, and the results are influenced by the conditions.

A series of tests were therefore planned to obtain some data on a number of variables commonly occurring under the test conditions employed in the formation of phosgene and volatile acids by decomposition of a vapor or gas in the presence of a flame or hot object.

The variables referred to include the humidity of the vapor or gas-air mixture undergoing examination, the temperature of the heated surface, and to some extent the constitution of the material forming the heated surface.

#### Fire and Explosion Test Procedure

In attacking the problems of fire and explosion hazards, the most practical procedure that appeared to be fundamentally sound was, first, to apply to the refrigerants and other products included in this investigation the laboratory tests (measurements of reactions with the oxygen of the air) which are discussed more fully below; and, second, to investigate the relation of the results of these tests to the actual fire hazard.

For this purpose tests of other gases or vapors of generally similar character, whose actual fire and explosion hazards have been well established by field experience, were included.

Gasoline vapor was employed as the main basis of comparison, its fire and explosion hazards having been established by practical experience over a wide range of conditions.

Illuminating gas, which has been used quite extensively by the public in hotels, apartments, and particularly in homes, was also included for comparison.

The laboratory tests referred to above, which have been developed as a measure of the reaction of gases or vapors with the oxygen of the air, and which serve as a basis of comparison of the fire and explosion hazards, include ignition temperature tests, limits of flammability or explosive range tests, explosion pressure-time tests, and flame propagation speed tests.

#### Refrigerant Manufacturers

Manufacturers of the various refrigerants tested were:

Ammonia—National Ammonia Co., Inc., St. Louis, and Morris & Co., Chicago.

Butane—Carbide & Carbon Chemicals Corp., South Charleston, W. Va.

Carbon dioxide—E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

Carbon tetrachloride—Dow Chemical Co., Midland, Mich.

Chloroform—Roessler & Hasslacher Chemical Co., Niagara Falls, N. Y.

Dichlorethylene—Roessler & Hasslacher Chemical Co.

Dichlorodifluoromethane—Kinetic Chemicals, Inc., Wilmington, Del.

Dichlorotetrafluoroethane—Kinetic Chemicals, Inc.

Ethane—Carbide & Carbon Chemicals Corp.

Ethyl bromide—Dow Chemical Co.

Ethyl chloride—E. I. duPont de Nemours & Co.

Gasoline—Standard Oil Co. of Indiana, Whiting, Ind.

Methyl bromide—Dow Chemical Co.

Methyl chloride—Roessler & Hasslacher Chemical Co.

Methylene chloride—Roessler & Hasslacher Chemical Co.

Monofluorotrichloromethane—Kinetic Chemicals, Inc.

Phosgene—(For testing the accuracy of the analytical method for the determination of phosgene)—Schering-Kahlbaum A. G.

Propane—Philfuels Co., Pontiac, Mich., and Carbide & Carbon Chemicals Corp.

Sulphur dioxide—E. I. duPont de Nemours & Co.

### Toxicity Tests

These tests relate to the comparative toxicity of the gases or vapors before any decomposition by flame or hot surfaces.

#### Methods of Test

In the following tests with the various refrigerants and other substances included in this investigation the guinea pigs were exposed for definite intervals of time to the respective vapors and gases in predetermined concentrations under similar conditions in the same test room.

The predetermined concentrations of the refrigerants and other substances included in this investigation were obtained by introducing weighed amounts of the gas or vapor into the test room.

Samples of the gas or vapor-air mixture in the test room were withdrawn at intervals during the test and the concentration checked by analysis. Additional quantities of gas or vapor, in amounts depending upon the results of the concentration determinations, were introduced into the room from time to time to maintain the predetermined concentration.

The test room is 9 ft. long, 7 ft. wide, and 8 ft. high. The net internal volume of the room, allowing for that space occupied by the apparatus, is 500 cu. ft. The walls and ceiling of the room are made of sheet iron coated with asphalt paint.

The floor is concrete coated with asphalt paint. A tightly fitting door and a glass observation window are provided. All joints in the walls and ceiling are sealed with asphaltum compound.

A glass tube passing through the wall of the room and terminating 1 ft. above the floor and 1 ft. from each of the two walls forming a corner, is provided for the introduction of the gases or vapors.

A fan for mixing the gases or vapors with the air in the room is located directly in front of the outlet of the tube. The fan is of the four-bladed type, 12 in. in diameter, and is driven at 1800 r.p.m. by an electric motor located outside of the room.

The actual hazard presented when a volatile refrigerant is discharged into the surrounding air, as happens when a leak or break in a refrigeration system occurs, depends upon the nature of the refrigerant, the amount discharged, and the surroundings.

If the discharged refrigerant is toxic, and the surroundings are such as to cause its confinement, as in a small closed room, the resulting con-

centration of fumes may endanger life.

Whether the refrigerant is toxic or not, it may constitute a life hazard under certain conditions if capable of being decomposed into toxic fumes by contact with a flame or very hot object.

If the discharged refrigerant is combustible, a fire or explosion may occur under conditions of confinement where there is present a source of ignition.

The effect upon the body of a toxic refrigerant in the form of vapor or gas when inhaled is dependent not only on its inherent or specific toxicity, but on its concentration in the air and the duration of the exposure. The concentration is of critical importance. Where low concentrations produce harmful effects, higher concentrations will produce more harmful effects.

In case of some gases or vapors, the difference between the concentration which may be tolerated and that which is lethal for a given duration of exposure is definitely small.

It is clear from the foregoing that the concentration is of fundamental importance in a comparison of the toxic or life hazards of refrigerants. It becomes necessary, therefore, to work out a basis for comparison of the hazards of refrigerants in terms of concentrations corresponding to certain limiting values met with in practice.

The range of concentrations of refrigerants resulting from leaks or breaks is limited in practice by more or less ventilation essential to normal activities, and the amount of charge of refrigerant, which in the ordinary household system is comparatively small (1 to 4 lb.) and if permitted to discharge into a room of about 1,000 cu. ft. capacity, the volume of an average kitchen, the resulting concentration of gas or vapor in air will be of the order of about 1/4 to 3 per cent by volume, the exact percentage depending upon the refrigerant and the degree of ventilation.

In commercial and industrial establishments, refrigerating systems contain larger charges of refrigerants, but the concentration of vapor or gas resulting from leaks or breaks will ordinarily be of a low order, owing to the usual size of the rooms, the general conditions of ventilation and openings to the outside air.

Where toxic or harmful effects are produced by a given concentration of a low order, it will not usually be necessary to include tests with higher concentrations, but where no harmful effects are produced by concentrations of a low order, tests with a higher concentration may be required.

It appears that a range or scale of durations of exposure of the following order, if employed in conjunction with suitable concentrations, will meet the practical requirements of this investigation: 5 min., 1/2 hr., 1 hr., and 2 hr.

Available data also indicate that a concentration of the order of 1/2 to 1 per cent by volume for the above range of exposures is applicable in making a comparison of refrigerants of a high order of toxicity.

It appears, therefore, that a low limit of concentration of this order will be of much practical significance.

No attempt is made in this investigation to determine the cumulative or chronic effects from recurrent or prolonged exposure.

The procedure therefore adopted for the toxicity tests includes the following basic concentrations and durations of exposure.

Concentrations of the order of 0.5 to 1.0% by vol. 5 min. 30 min. 1 hr. 2 hr. 2.0 to 2.5% by vol. 5 min. 30 min. 1 hr. 2 hr.

When the above concentrations produce no definite effects in an exposure of 2 hr. duration, higher concentrations are employed.

The guinea pigs were closely observed before, during, and

## REFRIGERANTS

(Continued from Page 8, Column 5)  
exposure of refrigerants to flames or hot surfaces.

It is in order first to consider the procedure to be employed in bringing about the formation of the decomposition products of the refrigerants undergoing examination, and second the procedure for tests of the comparative toxicity of the decomposition products.

The flame from a gas range is of primary importance as the basis for the comparative decomposition tests. The nature of this flame as ordinarily used in the kitchen varies, depending upon the primary air supply, from a luminous smoky flame (yellow to white) to a non-luminous (blue) or oxidizing flame. Both types of flame were employed in the decomposition tests.

Pressure of the gas or vapor-air mixture in the test room is maintained in equilibrium with that of the atmosphere by means of a vent located in the ceiling and provided with a shutter.

The test room door was sealed, and the interior shutters of the animal cage were closed. The vent in the ceiling of the test room was opened and the calculated quantity of gas or vapor to produce a predetermined concentration was introduced into the porcelain base.

The fan was operated throughout the test. The vent in the ceiling of the test room was closed after introduction of the gas or vapor.

The interior shutters to the cage were opened. The behavior of the guinea pigs during the test was observed through the windows in the doors of the compartments. At the end of 5 min. after the start of the test, the interior shutter on one compartment of the cage was closed and the animals in that compartment removed for examination.

Other animals were removed at the end of 30 min., 1 hr., and 2 hr., respectively, after the start of the test. Guinea pigs alive at the conclusion of the test and controls were retained 10 days for observation. Autopsies were conducted on some of the animals.

The behavior of the guinea pigs during the several tests will be found recorded together with data as to the temperature of the room, and in some cases the humidity, in a complete tabulation in the report.

### Toxicity Tests of Decomposition Products

These tests relate to the comparative toxicity of refrigerants and other substances included in this investigation in the presence of gas flames or hot surfaces.

The predetermined initial concentrations were obtained by introducing weighed amounts of the gas or vapor into the test room, employing the methods previously described.

Analytical tests to determine the chief constituents of the products of decomposition were conducted on samples withdrawn from the test room at the end of 5 and 30 min. after the start of the test.

These samples were withdrawn through glass tubes terminating directly in front of the animal cage. The details of the analytical methods

and the results obtained are recorded in the following section of this report entitled "Analytical Tests of Decomposition Products."

The basic initial concentrations and durations of exposure included the following:

| Initial concentrations<br>of the order of | Durations of<br>exposure |
|---|--------------------------|
| 0.5 to 1.0 per cent by volume             | 5 min. 30 min.           |
| 2.0 to 2.5 per cent by volume             | 5 min. 30 min.           |

In some cases it was found necessary to use higher concentrations.

For the tests in the presence of a gas flame a gas burner of the type commonly used in household gas ranges was mounted on a stand, 30 in. above the floor, in the corner of the test room opposite the animal cage and the fan. A thermocouple connected with a potentiometer was located 6 in. above and 6 in. to one side of the gas burner.

For the tests in the presence of hot metal surfaces in the form of resistance wire, two electric range heating units were mounted 30 in. above the floor in the corner of the test room opposite the animal cage and the fan.

These units are of the open coil type, 8 in. in diameter, rated at 2,000 watts, 115 volts. The heating elements consist of coils of nichrome wire in the form of a spiral supported by a porcelain base.

#### Procedure

When tests in the presence of gas flames were being conducted, the valve controlling the supply of illuminating gas to the gas burner was opened, and the illuminating gas was ignited at the burner by an electric spark from an induction coil located outside of the test room, the primary air supply to the gas burner being previously regulated so as to produce a nonluminous (blue) or oxidizing flame.

When tests in the presence of electric range units were being conducted, the electric circuit to the units was closed, instead of operating the gas burner. The interior shutters to the cage were then opened.

The behavior of the guinea pigs during the test was observed through the windows in the doors of the compartments. At the end of 5 min. after the start of the test, the shutter on one compartment of the cage was closed, and the animals in that compartment removed for examination.

Other animals were removed at the end of 30 min. after the start of the test.

A blank test with the gas flame was conducted, the procedure previously described being used except that no gas or vapor was introduced into the test room. Three animals removed from the room at the end of 5 min. and also three animals removed at the end of 30 min. after the start of the blank test appeared to be normal during the 10-day observation period.

The behavior of the guinea pigs during the several tests was recorded together with data as to the temperature of the room, and in some cases the humidity. A tabulation of the results is given at the conclusion of this section of the report.

#### Products of Decomposition Analyzed

Next series of tests was an analysis of the products of decomposition of the various refrigerants in the presence of gas flames, oil and wood fires, and hot metal surfaces.

Samples of the decomposition products were withdrawn from the test room at the end of 5 min. and 30 min. after the start of the tests for toxicity of decomposition products. Determinations of hydrochloric acid, free chlorine, phosphene, carbon dioxide, oxygen, and carbon monoxide were made on the samples.

Subsequent tests were conducted to determine ignition temperatures, limits of flammability, as well as explosion pressure time tests, and flame propagation tests (fully described in Nuckolls' report, but too extensive to be treated here).

#### Summary

No attempt has been made in this investigation to formulate the toxicological values of the refrigerants and other products tested. Nor has any attempt been made to establish close distinctions in the comparisons of toxic properties. It is to be noted that the chronic or cumulative effects of prolonged or recurrent exposures to the vapors or gases are not included in this investigation.

The conditions maintained in the tests were severe.\* Neither the test conditions nor the concentrations used can be asserted to be those which will exist in any given enclosure, since the size of such enclosure, the ventilation, and other variables are controlling factors.

The data obtained in this investigation, however, are comparable and serve as a practical measure of the

\*It will be noted that in order to obtain an accurate basis for comparison, the tests were conducted under conditions more severe than are encountered in practice. The test room is smaller than the average size kitchen, and no ventilation whatever is provided. Hence, effects shown by the tests are more severe than the effects obtainable under conditions to be anticipated in practice.

comparative hazards of refrigerants under working conditions.

#### Comparative Life Hazard of Refrigerants

When discharged into the surrounding air in the absence of flame or hot objects, the comparative life hazard of the refrigerants and other products included in this investigation appears to be of the following order, which for convenience is divided into six groups in accordance with the concentrations (by volume) and durations of exposure liable to produce lethal effects or serious injury:

Group 1—Gases or vapors which in concentrations of the order of  $\frac{1}{2}$  to 1 per cent for durations of exposure of the order of 5 min. are lethal or produce serious injury: sulphur dioxide.

Group 2—Gases or vapors which in concentrations of the order of  $\frac{1}{2}$  to 1 per cent for durations of exposure of the order of  $\frac{1}{2}$  hr. are lethal or produce serious injury: ammonia and methyl bromide.

Group 3—Gases or vapors which in concentrations of the order of 2 to 2 $\frac{1}{2}$  per cent for durations of exposure of the order of 1 hr. are lethal or produce serious injury: methyl formate, chloroform, and carbon tetrachloride.

Group 4—Gases or vapors which in concentrations of the order of 2 to 2 $\frac{1}{2}$  per cent for durations of exposure of the order of 2 hr. are lethal or produce serious injury: dichlorethylene, methyl chloride, and ethyl bromide.

Methylene chloride and ethyl chloride appear to classify as somewhat less toxic than Group 4, as pointed out later.

Group 5—This group includes gases or vapors much less toxic than Group 4 and (a) more toxic than Group 6: monofluorotrichloromethane (F-11) and carbon dioxide—and (b) those which available data indicate classify as either Group 5(a) or Group 6: butane, ethane, and propane.

Group 6—Gases or vapors which in

concentrations up to at least 20 per cent by volume for durations of exposure of the order of 2 hr. do not appear to produce injury: dichlorodifluoromethane (Freon) and dichlorotetrafluoroethane (F-114).

#### COMPARATIVE LIFE HAZARD OF REFRIGERANTS IN THE PRESENCE OF FLAME

##### Small Gas Flames

When in initial concentrations of  $\frac{1}{2}$  to 2% per cent by volume in the air surrounding non-luminous (blue) flames from an ordinary gas range such as is commonly used in a kitchen, the comparative life hazard of the following refrigerants and other substances included in this investigation appears to be of a lethal order for continuous durations of exposure of the order of 5 min. to  $\frac{1}{4}$  hr. or longer (no ventilation): carbon tetrachloride, chloroform, dichlorethylene, dichlorodifluoromethane (Freon), dichlorotetrafluoroethane (F-114), ethyl and methyl bromide, ethyl chloride, monofluorotrichloromethane (F-11), and methylene chloride.

The lethal duration of exposure for methyl chloride in concentrations of the above order is possibly somewhat longer than  $\frac{1}{4}$  hour but under  $\frac{1}{2}$  hour.

Analytical results of similar tests with the above gas flames luminous (primary air shut off), employing concentrations of carbon tetrachloride and dichlorodifluoromethane, respectively, of the order of 2 $\frac{1}{2}$  per cent by volume shows only slight differences between the resulting concentrations of volatile toxic decomposition products caused by the luminous and non-luminous flames. These differences are of no practical significance.

Results of analytical tests of samples of decomposition products withdrawn during the tests with animals are shown that the toxic decomposition products include volatile acids and phosgene. Free chlorine occurred in the de-

composition products of carbon tetrachloride, chloroform, and dichlorodifluoromethane. Free bromine occurred in the decomposition products of ethyl and methyl bromide.

Carbon monoxide in concentrations of the order of 0.5 per cent was present in the decomposition products of ethyl and methyl bromides only. These refrigerants in concentrations of the order of 2.5 per cent in air retarded combustion of the gas employed for the test flame.

This probably accounts for the presence of appreciable concentrations of carbon monoxide in the decomposition products of ethyl and methyl bromides.

The oxygen content of the atmospheres in the test room at no time during the test period was below 16.8 per cent.

In case of smaller flames the concentration of volatile acids and phosgene will be less, an ordinary gas range pilot light requiring over 2 hr. to produce a lethal concentration under the severe conditions existing in the (500 cu. ft.) test room.

##### Large Gas Flames

Contact of the above vapors or gases with larger gas flames in the concentrations of the order of those employed with small gas flames, may be expected to result in a somewhat higher concentration of volatile acids and probably of phosgene.

##### Oil and Wood Fires

When in initial concentrations of 5 per cent by volume in air surrounding oil and wood fires, no ventilation being provided, the above vapors and gases yield volatile toxic products of decomposition in lethal concentrations.

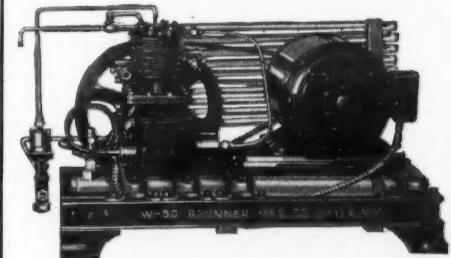
##### Nature of Warning

The volatile toxic decomposition products or fumes produced by the above refrigerants, including also chloroform and carbon tetrachloride, (Concluded on Page 10, Column 1)

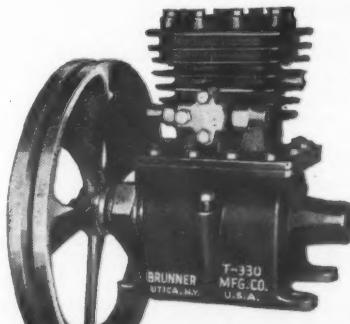
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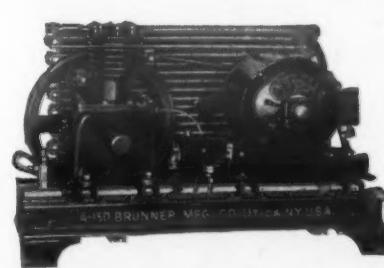
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# REFRIGERANTS

(Concluded from Page 9, Column 5)  
in the presence of flames are exceedingly irritating, and not only give definite warning of their presence even when in very small concentrations but cause people to make efforts to escape.

## Humidity

Results of the animal tests apparently do not show the differences in phosgene concentration resulting from varying the humidity.

The analytical results, however, show that increasing humidity of the air in the test room causes a marked decrease in the resulting concentration of both phosgene and volatile acids in the case of dichlorodifluoromethane.

In the case of carbon tetrachloride increasing humidity of the air causes very little change in the resulting concentration of phosgene but a marked decrease in the resulting concentration of volatile acids.

It is therefore quite clear that increasing humidity tends to decrease rather than increase the hazards of the decomposition products due to phosgene and volatile acids.

## Practical Significance of Data

Assuming a concentration of vapor or gas of the order of  $\frac{1}{2}$  to  $2\frac{1}{2}$  per cent by volume in the presence of the flames from a gas range in an average size kitchen of 1,000-cu. ft. capacity having absolutely no ventilation, the concentrations of toxic products of decomposition would be about half (or less) of those obtained in the test room of 500-cu. ft. capacity.

Allowing for only moderate ventilation essential to normal activities, the concentrations of toxic fumes would be still further reduced.

Assuming exposure of brief duration, the life or toxic hazard of the above refrigerants in the presence of flames such as are commonly employed in ordinary kitchens under conditions to be anticipated when a leak or break occurs in a unit refrigerating system will ordinary be very small.

When a break occurs in a multiple system, the life hazard will ordinarily be somewhat higher, depending upon the resulting concentrations of fumes in the air.

In commercial and industrial establishments where refrigerating systems contain larger charges, the life hazard when a break occurs will depend upon the resulting concentration of fumes, which, however, will ordinarily be of a low order, owing to the usual size of the rooms and the conditions of ventilation.

The importance of maintaining adequate ventilation to prevent the possibility of accumulation of fumes in dangerous concentrations in commercial and industrial establishments where any of the above refrigerants are used is evident.

The oil fires employed in the tests were of relatively high intensity, and the wood fires were of moderate intensity. In both cases the test conditions were severe, being comparable with only exceptional fire conditions, and are not to be anticipated under normal working conditions.

The toxic hazard presented will depend upon the concentration of the refrigerant and the degree of confinement of the fumes. Under actual fire conditions convection currents of air rapidly dilute and disperse fumes, except under conditions of confinement. In closed places, particularly where the prompt exit of persons is not possible, there is danger.

## COMPARATIVE LIFE HAZARD OF REFRIGERANTS IN THE PRESENCE OF SURFACES AT HIGH TEMPERATURES

### Small Objects

When in initial concentrations of

the order of 5 per cent by volume in the air surrounding hot surfaces (750 to 775° C., cherry to bright red) in the form of open coil resistance wire units of electrical ranges such as are used in kitchens for cooking, the comparative life hazard of dichlorodifluoromethane and dichlorotetrafluoroethane for durations of exposure of the order of  $\frac{1}{2}$  hr. (no ventilation provided) is not lethal, no appreciable amount of toxic decomposition products being formed.

Under the above conditions methyl chloride yields an appreciable amount of decomposition products but not in concentrations dangerous to life for durations of exposure of the order of  $\frac{1}{2}$  hr.

Carbon tetrachloride, monofluorotrichloromethane, and methylene chloride under the above conditions (no ventilation being provided) yield toxic decomposition products in lethal concentrations for durations of exposure of the order of  $\frac{1}{2}$  hr.

### Large Objects

When in initial concentrations of the order of 5 per cent by volume and in contact with the inner surface of an iron cylinder (diameter, 6 in. length, 26 in.) heated to a temperature of 550° C., the following refrigerants and other substances included in this investigation yield toxic products of decomposition in lethal concentrations: carbon tetrachloride, chloroform, dichloroethylene, dichlorodifluoromethane, dichlorotetrafluoroethane, ethyl and methyl bromide, ethyl chloride, methylene chloride, and monofluorotrichloromethane.

It will be noted that the above test conditions are severe, and are not to be anticipated under normal working conditions. Under fire conditions, the toxic hazard presented will depend upon the amount or concentration of the refrigerant and the confinement, if any, of the liberated fumes.

Fumes are usually rapidly dissipated under fire conditions by the convection currents of air. In small closed places, particularly where the prompt exit of a person is not possible, there will be danger.

### COMPARATIVE FIRE AND EXPLOSION HAZARDS OF REFRIGERANTS

When discharged into the surrounding air, the comparative fire and explosion hazards of the refrigerants and other products included in this investigation appear to be of the following order: ethane, propane, butane, and methyl formate are in a class with illuminating gas and the vapor of gasoline.

Ethyl chloride, methyl chloride, dichloroethylene, and ethyl bromide are moderately flammable, being much less hazardous than gasoline but more hazardous than ammonia. Ethyl chloride is more hazardous and ethyl bromide is less hazardous than the other members of this group.

Although ammonia is capable of forming flammable and explosive mixtures with air within certain limits (16 to 25 per cent by volume), its relative fire and explosion hazard is small. It is combustible in air, i. e., propagates flames only when present in comparatively high concentrations.

Methyl bromide is weakly flammable in air only within exceedingly narrow limits, its fire hazard being very small from a practical standpoint.

Methylene chloride (dichloromethane) is practically nonflammable and nonexplosive at ordinary temperatures, but at higher temperatures under favorable laboratory test conditions is capable of forming weakly combustible mixtures with air.

Formation of combustible mixtures by methylene chloride, however, under practical conditions even at higher temperatures is extremely unlikely, and its fire hazard is therefore very small.

Carbon dioxide, carbon tetrachloride, dichlorodifluoromethane (Freon), dichlorotetrafluoroethane (F-114), monofluorotrichloromethane (F-11), and sulfur dioxide differ widely from each other in chemical properties but are alike in not being capable of propagating flame and are classed as noncombustible and nonflammable.

The above classification is based on the results of laboratory tests, including ignition temperature tests, limits of flammability or explosive range tests, explosion pressure-time tests, and flame propagation speed tests. In addition, consideration has been given to the vapor or gas density (diffusion), the products of combustion, and the chemical stability.

### COMMENTS ON THE REFRIGERANTS AND OTHER SUBSTANCES INCLUDED IN THIS INVESTIGATION

#### Ammonia

Ammonia is an irritant gas having a sharp, penetrating odor. An outstanding serious effect produced by ammonia in concentrations of the order of  $\frac{1}{2}$  per cent for duration of exposure of the order of  $\frac{1}{2}$  hour is blindness. A concentration of 0.03 per cent ammonia in air for duration of exposure of  $\frac{1}{2}$  to 1 hr., according to

Lehmann, does not cause serious effects.

Even in concentrations of a very low order (below the danger line), ammonia gives definite warning of its presence, owing to its sharp odor.

If exit is possible, one is not likely to remain in dangerous concentrations of ammonia long enough to receive serious injury. It is to be noted, however, that high concentrations of ammonia may incapacitate one almost immediately.

If the eyes and respiratory tract are protected, lethal concentrations of dry ammonia are tolerated by the skin within certain limits.

Ammonia is combustible in air, that is, propagates flame when present in comparatively high concentrations (16 to 26 per cent by volume). An explosion of ammonia when in high concentrations is possible. Usually, however, under practical conditions, the combustion of ammonia is slow and weak.

#### Butane, Ethane, and Propane

The data obtained in this investigation indicate that concentrations of the order of 5 per cent by volume for durations of exposure of the order of 2 hr. are not dangerous to life.

According to Dr. E. E. Smith, 6.3 per cent by volume of propane when inhaled by white rats for one hour (without deficiency of oxygen) produces slight drowsiness, and 37.5-51.7 per cent when inhaled for two hours produces muscular weakness followed by mild anesthesia.

In respect to the fire and explosion hazard, butane, ethane, and propane are in a class with illuminating gas and the vapor of gasoline. The percentages by volume of these gases required to form a flammable mixture with air are as follows: butane 1.6, ethane, 3.3, and propane, 2.3.

The above gases, having practically no odor, do not give warning of their presence in the air in dangerous concentrations.

#### Carbon Dioxide

There are data in the literature on the physiological effects of carbon dioxide on animals and men both with and without oxygen deficiency, but the extreme limit of human tolerance to high concentrations does not appear to have been fully established.

Its physiological action is evidently complex, and no attempt to classify its hazard within close limits is made in this report. It appears to come within the limits of Group 5(a).

It is not an inert gas physiologically. In mild concentrations (3 to 5 per cent by volume) it acts as a respiratory stimulant.

Brown concludes from a study of the effects of comparatively high concentrations of carbon dioxide on man that none of the men could have withstood 10 per cent carbon dioxide in air for longer than 10 min. without losing consciousness.

Carbon dioxide is odorless, but its physiological effects when breathed in mild or moderate concentrations serve in a measure as a warning of its presence. In concentrations, however, much above 10 per cent, the physiological action may be too rapid in producing stupefaction or loss of consciousness to serve as adequate warning.

Carbon dioxide has been used extensively in industry and as a fire extinguisher. The record indicates that its actual life hazard under ordinary conditions of use is small.

#### Carbon Tetrachloride

Carbon tetrachloride is not used as a refrigerant but is included in this investigation for comparative purposes because it is related chemically to several of the refrigerants, and has been used extensively as a fire extinguisher agent for many years. It is also used to some extent as a cleaning fluid.

#### Chloroform

Chloroform is not used as a refrigerant but is included in this investigation for comparative purposes as it has been used extensively as an anesthetic. It is classified in Group 3, being lethal to guinea pigs in concentrations of the order of 2 to  $2\frac{1}{2}$  per cent by volume for durations of exposure of the order of 1 hour.

#### Dichlorethylene

Dichlorethylene is an anesthetic but to a less degree than chloroform.

In concentrations of the order of 2 to  $2\frac{1}{2}$  per cent by volume for durations of exposure of the order of 2 hours, it caused the death of guinea pigs. It falls in Group 4.

The odor of dichlorethylene resembles that of chloroform. It cannot be said to give adequate warning of danger. Its physiological action, however—lachrymation within 1 to 2 min.—may serve in a measure to give some warning before serious physiological effects are produced.

It is decomposed by contact with flame or very hot objects, forming toxic fumes, which are exceedingly irritating, and therefore give adequate warning of their presence.

Dichlorodifluoromethane (Freon) and Dichlorotetrafluoroethane (F-114) Dichlorodifluoromethane appears to show no toxic effects in concentrations

up to at least 20 per cent by volume for durations of exposure of the order of 2 hr. In tests with concentrations of the order of 28.5 to 30.4 per cent by volume for durations of exposure of the order of 2 hr., some physiological action is apparent, but whether or not this is caused primarily by oxygen deficiency is not shown by our data.

In our tests with dichlorotetrafluoroethane in concentrations of the order of 4 to 5 per cent by volume for duration of exposure of the order of 2 hr., no toxic action was evident.

In the presence of flame and very hot surfaces (550° C.), dichlorodifluoromethane and dichlorotetrafluoroethane are decomposed with the formation of toxic products, which are exceedingly irritating, and therefore give adequate warning of their presence in the air even in concentrations of a very low order.

The danger from the fumes depends upon the concentration and duration of exposure, but under ordinary conditions, except in unventilated places, serious danger to life is not involved.

It is to be noted, however, that in the presence of open coil hot resistance wire units such as are used in electrical ranges for cooking, even when heated to a cherry red heat (750° C.), practically no toxic decomposition products are formed during a period of exposure of the order of  $\frac{1}{2}$  hr. in a room without any ventilation.

Dichlorodifluoromethane and dichlorotetrafluoroethane are non-combustible and non-explosive.

#### Ethyl Bromide

Ethyl bromide is an anesthetic. In concentrations of the order of 2 to  $2\frac{1}{2}$  per cent by volume for durations of exposure of the order of 2 hr., it causes the death of guinea pigs. It falls in Group 4.

Ethyl bromide does not give adequate warning of its presence in air in concentrations dangerous to life.

It is readily decomposed into volatile toxic products (HBr and Br<sub>2</sub>) in the presence of flame and very hot surfaces. These products are very irritating and therefore give adequate warning of their presence.

It is moderately flammable, being much less hazardous than gasoline but more hazardous than ammonia.

#### Ethyl Chloride

Ethyl chloride is an anesthetic. In concentrations of  $2\frac{1}{2}$  per cent by volume, it does not cause the death of guinea pigs for durations of exposure of the order of 2 hr. Ethyl chloride appears to classify as somewhat less toxic than Group 4.

Ethyl chloride gives some warning of its presence, but a person might tolerate exposures to it in dangerous concentrations until helpless.

It is decomposed by contact with flame or very hot surfaces, forming toxic and irritating fumes, which give adequate warning of their presence.

Ethyl chloride is moderately flammable. It is much less hazardous than gasoline but more hazardous than ammonia.

#### Methyl Bromide

Methyl bromide in concentrations of the order of 0.7 to 1.0 per cent for durations of exposure of the order of  $\frac{1}{2}$  hr. caused the death of guinea pigs.

Its odor is not distinctly unpleasant, and it cannot be said to give definite warning of its presence in dangerous concentrations.

It will be noted from the test data in this report that there is a definitely delayed toxic effect in the case of this compound.

Methyl bromide readily decomposes into toxic products in the presence of flame and surfaces at high temperatures. These products include hydrobromic acid (HBr) and small amounts of bromine (Br<sub>2</sub>).

Its fire hazard is very small from a practical standpoint. In certain concentrations it has an extinguishing effect on fires. This phase of the subject does not come within the scope of this report.

#### Methyl Chloride

Methyl chloride is an anesthetic. In concentrations of the order of 2 to  $2\frac{1}{2}$  per cent by volume for durations of exposure of the order of 2 hr., it causes the death of guinea pigs. It falls in Group 4. It will be noted that there is a definitely delayed toxic action in the case of methyl chloride.

It does not give definite warning of its presence in air in concentrations dangerous to life. For use as a refrigerant, however, methyl chloride usually contains volatile substances that give adequate warning of their presence in the air, and thus reduce the

actual life hazard.

It is decomposed by contact with flame or very hot surfaces, producing toxic fumes (HCl and COCl<sub>2</sub>), which are, however, very irritating and give adequate warning.

It is to be noted that in the presence of heated resistance wire units such as are used in kitchens, the small amount of decomposition products formed are not liable to endanger life for short durations of exposure.

Methyl chloride is moderately flammable, being much less hazardous than gasoline but more hazardous than ammonia.

## Methylene Chloride (Dichloromethane)

Methylene chloride in concentrations of the order of  $2\frac{1}{2}$  per cent by volume for durations of exposure of the order of 2 hr. does not cause the death of guinea pigs. Concentrations, however, of the order of 5 per cent by volume for durations of exposure of the order of  $\frac{1}{2}$  hr. are lethal to guinea pigs.

Methylene chloride, therefore, appears to classify as somewhat less toxic than Group 4.

It will be noted that in one series of tests with concentrations of the order of 5 per cent by volume, the initial relative humidity of the air was 24 per cent; and in the other series of tests with concentrations of the order of 5 per cent by volume, the initial relative humidity of the air was 72 per cent.

The difference in humidity did not appear to cause any decided difference in the physiological response of the guinea pigs.

The physiological action of methylene chloride may be regarded as giving some warning of its presence.

It is decomposed by contact with flame or very hot surfaces, with the formation of toxic fumes, which are, however, exceedingly irritating and therefore give adequate warning of their presence.

Methylene chloride is practically non-flammable and non-explosive at ordinary temperatures, but at higher temperatures, under favorable laboratory conditions, it is capable of forming weakly combustible mixtures with air. Formation of combustible mixtures by it under practical conditions, even at higher temperatures, is regarded as extremely unlikely.

## Methyl Formate

Methyl formate is an irritant, and gives definite warning of its presence. In concentrations of the order of 2 to  $2\frac{1}{2}$  per cent by volume for durations of exposure of the order of 1 hr., it caused the death of guinea pigs. It appears to classify in Group 3.

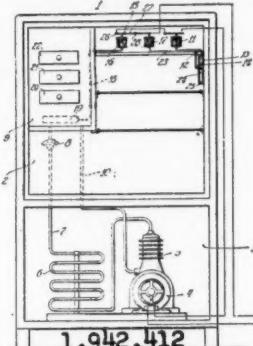
Methyl formate is capable of forming flammable and explosive mixtures with air. Its fire and explosion hazard is in a class with that of illuminating gas and the vapor of gasoline.

## PATENTS

Issued Jan. 9, 1934

1,942,412. MEANS FOR DEFROSTING COOLING ELEMENT OF MECHANICAL REFRIGERATORS. John A. Dienner, Greenville, S. C. assignor to Etta M. Lindsay, Greenville, S. C. Application Aug. 22, 1927. Serial No. 214,490. 16 Claims. (Cl. 62-4.)

1. In a refrigerator, a refrigerating com-



partment and a cooling element associated with said compartment, mechanically operated means for lowering the temperature of said cooling element, a thermal responsive device responsive to the temperature of said cooling element, and a thermal responsive device responsive to the temperature of said compartment, and means for controlling said mechanical means in accordance with the temperature differential between said thermal responsive devices.

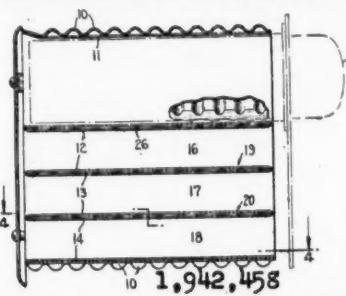
1,942,433. AUTOMATIC UNLOADER FOR COMPRESSORS. Robert F. Lindsay, Greenville, S. C. assignor to Etta M. Lindsay, Greenville, S. C. Application Oct. 16, 1930. Serial No. 489,178. 4 Claims. (Cl. 230-22.)

1. An automatic unloader for a motor driven compressor comprising in combination, a by-pass conduit connecting the discharge side to the suction side; a normally closed differential pressure operated valve in said by-pass conduit; a normally closed valve connected to relieve the seating pressure on said differential valve; an electromagnet operatively associated with said relief valve and connected in circuit with the compressor motor and means connected between the electromagnet and the relief valve normally to hold said relief valve closed and to open said relief valve when the motor circuit is broken.

1,942,458. SECONDARY COOLING ELEMENT. Robert S. Taylor and Roy A. Heim, Evansville, Ind., assignors to Electrolux Servel Corp., New York, N. Y., a

corporation of Delaware. Application May 16, 1931. Serial No. 537,862. 8 Claims. (Cl. 62-95.)

5. In combination, a primary cooling element and a secondary cooling element comprising sheet metal plates welded together at their edges and spaced apart by



corrugations in some of said plates to form a plurality of passages extending around and between said primary element and plurality of freezing chambers below said primary element.

1,942,509. REFRIGERATOR DOOR COVERING ATTACHMENT. Walter F. Davis and Carl E. Norelius, St. Paul, Minn., assignors to Seeger Refrigerator Co., St. Paul, Minn., a corporation of Minneapolis. Application Dec. 6, 1930. Serial No. 500,602. 9 Claims. (Cl. 20-35.)

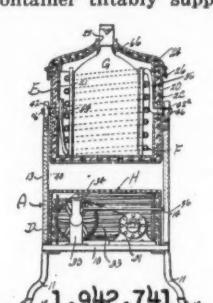
1. A refrigerator door covering attachment including a clip member having an outwardly projecting flange, a door covering having an inwardly projecting flange under which said clip flange is adapted to engage, and a flange extending virtually at right angles to said clip flange adapted to provide an attaching means through which screws may extend to anchor said clip to the refrigerator door frame.

1,942,696. ICE CREAM FREEZER CONSTRUCTION. Walter R. Helwege, Beloit, Wis., assignor to Taylor Freezer Corp., Beloit, Wis., a corporation of Delaware. Application Sept. 1, 1932. Serial No. 631,333. 5 Claims. (Cl. 257-212.)

2. An ice cream freezer comprising a vertical cylindrical cream can, an insulated wall surrounding the can and spaced apart therefrom providing an enclosed air space, a conical brine distributor surrounding the upper end of said can and means for closing the top of said distributor, the lower edge of said distributor being crimped and arranged with portions of the edge alternately touching and alternately spaced apart from said cream can to provide a plurality of adjacent small apertures, means for supplying brine to said distributor under pressure, and means for draining the brine from said air space.

1,942,741. WATER COOLER. Louis L. Austin, Philadelphia, Pa. Application Jan. 2, 1931. Serial No. 506,246. 21 Claims. (Cl. 62-141.)

1. In liquid cooling apparatus the combination of a supporting frame, an insulated container tiltably supported upon



said frame, means associated with said container for receiving liquid containing a vessel in an upright position with an upper discharge portion of the vessel extending from the container whereby upon tipping of the container the liquid may be dispensed from the vessel, and mechanical refrigerating apparatus supported on said frame including heat abstracting device disposed within said insulated container in a thermal interchange relation with said vessel and the liquid contained therein.

1,942,742. WATER COOLER. Louis L. Austin, Philadelphia, Pa. Application March 27, 1931. Serial No. 525,760. 12 Claims. (Cl. 62-141.)

1. In a liquid cooling apparatus the combination of an insulated cabinet having a cooling compartment therein, means in said cabinet for removably supporting entirely therein an inverted vessel containing liquid to be cooled, draft means connected with said vessel and extending in a sealed relation through said cabinet for selective withdrawal of liquid directly from the vessel at a point exteriorly of the cabinet without passing the liquid through an auxiliary cooling chamber, a mechanical refrigerating unit for maintaining said cabinet cooling compartment at a desired low temperature, and a second vessel containing a liquid to be cooled in pre-cooled storage in said cooling compartment of the cabinet.

1,942,842. COOLING UNIT FOR MECHANICAL REFRIGERATION. George J. Smith, Los Angeles, Calif. Application June 19, 1930. Serial No. 462,330. 5 Claims. (Cl. 62-95.)

2. A refrigerator cooling unit having a box-like structure with a pair of walls having a space with cooling coils therein, the said space surrounding the coils having a filling of silicate of soda in liquid form.

1,943,006. VAPORIZER FOR REFRIGERATORS. Allen R. Cosgrove, York, Pa., assignor to Martin-Parry Corp., York, Pa., a corporation of Delaware. Application May 3, 1930. Serial No. 449,650. 7 Claims. (Cl. 62-95.)

2. An expansion means for automatic refrigeration, comprising a tank for receiving refrigerant and discharging vapors, said tank having walls depending therefrom, each of said walls having a series of corrugations formed therein and in communication with said tank, the convex portions of at least some of said corrugations having longitudinally extending radiating fins attached thereto to increase the radiating surface thereof.

1,943,007. VAPORIZER FOR REFRIGERATORS. Allen R. Cosgrove, York, Pa.,

assignor to Martin-Parry Corp., York, Pa., a corporation of Delaware. Application May 3, 1930. Serial No. 449,651. 4 Claims. (Cl. 62-95.)

3. A vaporizing element for refrigerators comprising a pair of stamped complementary sections, said sections providing a refrigerant tank of tubular formation and truly vertically depending sheet metal stampings maintained in contacting relationship with each other, said stampings being corrugated to provide passageways communicating with the tank, and means surrounding the refrigerant tank to reinforce the same.

1,943,019. PREPARATION OF FROZEN MEAT AND THE LIKE. Grover Ralph Henney and Charles Taylor Walter, Chicago, Ill., assignors to Swift & Co., Chicago, Ill., a corporation of Illinois. No drawing. Application Jan. 27, 1931. Serial No. 511,644. 5 Claims. (Cl. 99-14.)

1. The method of producing a comminuted flesh food product consisting in, first, subjecting the product to temperatures below freezing until the product is reduced to a semi-frozen condition, comminuting while in such semi-frozen condition, and pressing a collection of the resulting comminuted semi-frozen products to a desired form.

1,943,091. COMPRESSOR. Wilhelm Kurt Schmid, Berlin, Germany. Application Oct. 24, 1931. Serial No. 570,897, and in Germany Oct. 23, 1930. 1 Claim. (Cl. 230-202.)

A compressor comprising a crank case having its top edge formed with a cylindrical groove, a plain tubular cylinder having its bottom edge seated in said groove, a plain substantially hemispherical cover seated on the top edge of said cylinder, a piston mounted in said cylinder for axial reciprocating motion, a horseshoe strap having its free ends anchored in said crank case and a screw bolt extending across the middle portion of said strap and bearing on said cylinder cover so as to form together with said strap the sole coupling means for said crank case, cylinder and cylinder cover.

1,943,116. REFRIGERATING SYSTEM. Henry O. Forrest, West Englewood, Lee Van Horn, Elizabeth, and Percy C. Keith, Short Hills, N. J., and Robert B. Crawford, Brooklyn, N. Y. Application March 14, 1932. Serial No. 598,558. 8 Claims. (Cl. 62-170.)

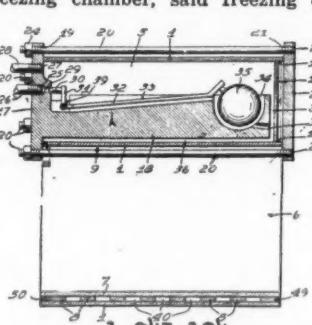
1. A method of cooling a refrigerating medium including the steps of subjecting said medium to the action of a medium having lower vapor pressure characteristics than said refrigerating medium, cooling said second medium and subsequently subjecting said refrigerating medium to the action of said cooled medium of lower vapor pressure characteristics.

1,943,121. AIR CONDITIONING FOR RAILWAY CARS. William F. Kiesel, Jr., Hollidaysburg, Pa. Application Nov. 12, 1931. Serial No. 574,512. 13 Claims. (Cl. 62-24.)

1. The combination with a railway car of means for cooling the air therein including an ice chamber and radiators outside of and adjacent the same, all thermosinsulatingly housed in a common casing beneath the car, and means for the circulation of air from the interior of the car through said casing, in contact with said radiators, and back into the car.

1,943,124. REFRIGERATING UNIT. Richard W. Kritzer, Chicago, Ill., assignor, by mesne assignments, to Edwin W. Hammer, New York, N. Y. Application Feb. 20, 1929. Serial No. 341,525. 7 Claims. (Cl. 62-95.)

3. In a refrigerating system, a refrigerating unit comprising a float chamber, said freezing chamber,



said frame, means associated with said container for receiving liquid containing a vessel in an upright position with an upper discharge portion of the vessel extending from the container whereby upon tipping of the container the liquid may be dispensed from the vessel, and mechanical refrigerating apparatus supported on said frame including heat abstracting device disposed within said insulated container in a thermal interchange relation with said vessel and the liquid contained therein.

1,943,125. WATER COOLER. Louis L. Austin, Philadelphia, Pa. Application Jan. 2, 1931. Serial No. 506,246. 21 Claims. (Cl. 62-141.)

1. In liquid cooling apparatus the combination of a supporting frame, an insulated container tiltably supported upon

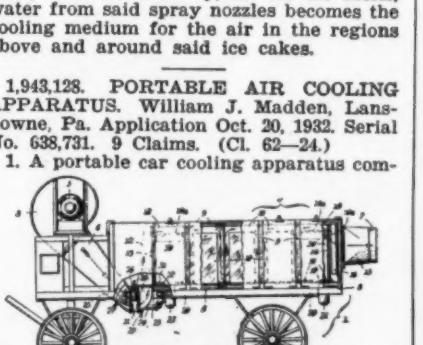
said frame, means associated with said container for receiving liquid containing a vessel in an upright position with an upper discharge portion of the vessel extending from the container whereby upon tipping of the container the liquid may be dispensed from the vessel, and mechanical refrigerating apparatus supported on said frame including heat abstracting device disposed within said insulated container in a thermal interchange relation with said vessel and the liquid contained therein.

1,943,127. PORTABLE AIR COOLING APPARATUS. William J. Madden, Lansdowne, Pa. Application Oct. 20, 1932. Serial No. 638,730. 6 Claims. (Cl. 62-133.)

1. An air cooling unit including a cooling chamber adapted to be substantially filled with cakes of ice spaced longitudinally within the chamber, the interior surfaces of said cooling chamber defining with the surfaces of said ice cakes narrow passages for a current of air, spray nozzles directed downward between said ice cakes to form shower curtains across said air passages, and means for conducting ice water from the bottom of said cooling chamber to said spray nozzles, whereby, as the ice melts, water from said spray nozzles becomes the cooling medium for the air in the regions above and around said ice cakes.

1,943,128. PORTABLE AIR COOLING APPARATUS. William J. Madden, Lansdowne, Pa. Application Oct. 20, 1932. Serial No. 638,731. 9 Claims. (Cl. 62-24.)

1. A portable car cooling apparatus com-



1,943,129. VAPORIZER FOR REFRIGERATORS. Allen R. Cosgrove, York, Pa.,

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prising a cooling chamber having a duct connection with the car to be cooled, said chamber being divided into compartments, each adapted to be substantially filled with ice, a blower for effecting a circulation of air through said chamber around said ice whereby the air is cooled by successive stages, radiator in the air passages, said radiator being disposed below the bottom of said chamber and in advance of one end thereof, and means for discharging water resulting from the melting of the ice by gravity through said radiator.

1,943,232. METHOD AND APPARATUS FOR PRODUCING LOW TEMPERATURE HIGH PRESSURE LIQUID CARBON DIOXIDE. Frank R. Zumbro, Waynesboro, Pa., assignor to Frick Co., Waynesboro, Pa., a corporation of Pennsylvania. Application Oct. 15, 1928. Serial No. 312,702. 7 Claims. (Cl. 62-121.)

1. A pre-compressing and cooling system for a snow making system comprising a series of compressors having coolers arranged therebetween in series, a liquid filtering system in said series, a condenser, a plurality of liquid coolers, means for mixing a portion of high pressure, low temperature fluid with the suction gases to the compressors, whereby a low temperature gas is delivered to the compressor stages, substantially as set forth.

5. The method of making carbon dioxide which consists in compressing carbon dioxide through a series of stages, cooling the gas between each of the compressing stages and mixing cold gas therewith, condensing the gas after passing through the last compressing stage, expanding a portion of the liquid to cool the remainder while keeping the remainder under approximately the same pressure, expanding the cold liquid to a snow machine and conducting all gaseous carbon dioxide from the snow machine and introducing it into gaseous carbon dioxide prior to the entry of said gas into the first compression stage, substantially as set forth.

1,943,268. CHEMISTRY. Joseph Fleischer, Dayton, Ohio, assignor to Frigidaire Corp., Dayton, Ohio, a corporation of Delaware. No Drawing. Application April 30, 1932. Serial No. 608,573. 15 Claims. (Cl. 62-170.)

1. A hold-over solution for refrigerating apparatus comprising a plurality of liquids, in the mixture of which one liquid freezes at a constant temperature leaving liquid remaining interspersed between the crystals.

1,943,288. PREPARATION OF FROZEN MEAT AND THE LIKE. Henry O. Forrest, West Englewood, Lee Van Horn, Elizabeth, and Percy C. Keith, Short Hills, N. J., and Robert B. Crawford, Brooklyn, N. Y. Application March 14, 1932. Serial No. 598,558. 8 Claims. (Cl. 62-170.)

1. The combination with a railway car of means for cooling the air therein including an ice chamber and radiators outside of and adjacent the same, all thermosinsulatingly housed in a common casing beneath the car, and means for the circulation of air from the interior of the car through said casing, in contact with said radiators, and back into the car.

1,943,290. REFRIGERATING UNIT. Richard W. Kritzer, Chicago, Ill., assignor, by mesne assignments, to Edwin W. Hammer, New York, N. Y. Application Feb. 20, 1929. Serial No. 341,525. 7 Claims. (Cl. 62-95.)

3. In a refrigerating system, a refrigerating unit comprising a float chamber, said freezing chamber,

1,943,291. REFRIGERATING APPARATUS. William J. Madden, Lansdowne, Pa. Application Oct. 20, 1932. Serial No. 638,730. 6 Claims. (Cl. 62-133.)

1. An air cooling unit including a cooling chamber adapted to be substantially filled with cakes of ice spaced longitudinally within the chamber, the interior surfaces of said cooling chamber defining with the surfaces of said ice cakes narrow passages for a current of air, spray nozzles directed downward between said ice cakes to form shower curtains across said air passages, and means for conducting ice water from the bottom of said cooling chamber to said spray nozzles, whereby, as the ice melts, water from said spray nozzles becomes the cooling medium for the air in the regions above and around said ice cakes.

1,943,292. PORTABLE AIR COOLING APPARATUS. William J. Madden, Lansdowne, Pa. Application Oct. 20, 1932. Serial No. 638,731. 9 Claims. (Cl. 62-24.)

1. A portable car cooling apparatus com-

1,943,293. VAPORIZER FOR REFRIGERATORS. Allen R. Cosgrove, York, Pa., assignor to Martin-Parry Corp., York, Pa., a corporation of Delaware. Application May 3, 1930. Serial No. 449,650. 7 Claims. (Cl. 62-95.)

2. An expansion means for automatic refrigeration, comprising a tank for receiving refrigerant and discharging vapors, said tank having walls depending therefrom, each of said walls having a series of corrugations formed therein and in communication with said tank, the convex portions of at least some of said corrugations having longitudinally extending radiating fins attached thereto to increase the radiating surface thereof.

1,943,294. VAPORIZER FOR REFRIGERATORS. Allen R. Cosgrove, York, Pa.,

assignor to Martin-Parry Corp., York, Pa., a corporation of Delaware. Application May 3, 1930. Serial No. 449,651. 4 Claims. (Cl. 62-95.)

3. A vaporizing element for refrigerators comprising a pair of stamped complementary sections, said sections providing a refrigerant tank of tubular formation and truly vertically depending sheet metal stampings maintained in contacting relationship with each other, said stampings being corrugated to provide passageways communicating with the tank, and means surrounding the refrigerant tank to reinforce the same.

1,943,295. VAPORIZER FOR REFRIGERATORS. Allen R. Cosgrove, York, Pa.,

assignor to Martin-Parry Corp., York, Pa., a corporation of Delaware. Application May 3, 1930. Serial No. 449,652. 4 Claims. (Cl. 62-95.)

4. An automatic unloader for a motor driven compressor comprising in combination, a by-pass conduit connecting the discharge side to the suction side; a normally closed differential pressure operated valve in said by-pass conduit; a normally closed valve connected to relieve the seating pressure on said differential valve; an electromagnet operatively associated with said relief valve and connected in circuit with the compressor motor and means connected between the electromagnet and the relief valve normally to hold said relief valve closed and to open said relief valve when the motor circuit is broken.